

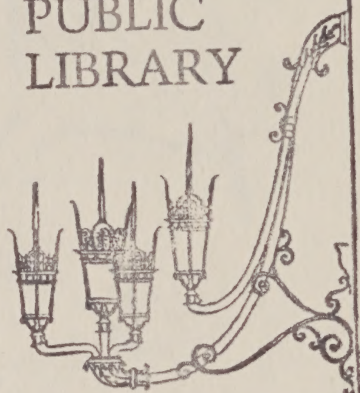
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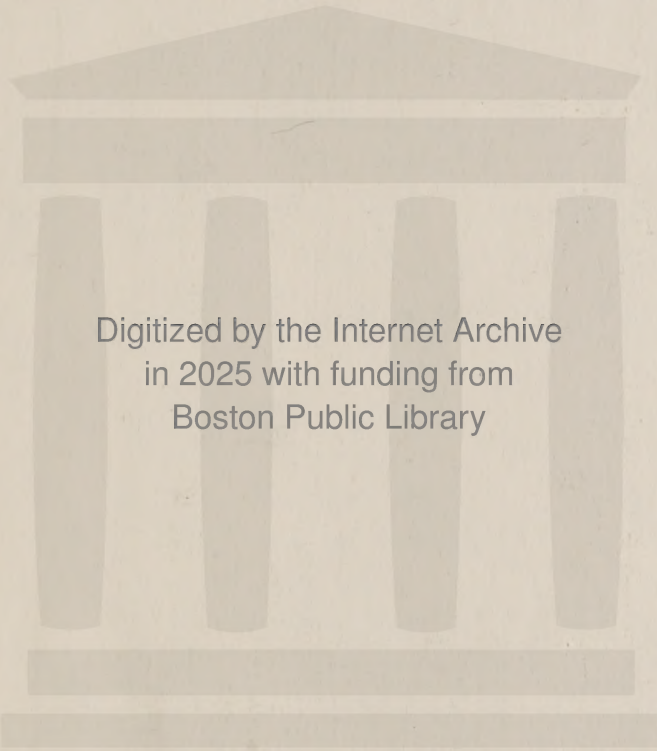
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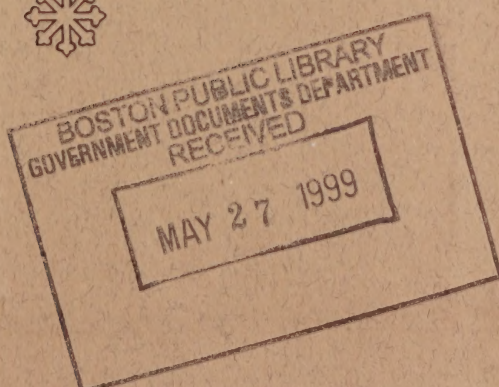
# INVESTIGATION OF THE ASSASSINATION OF PRESIDENT JOHN F. KENNEDY

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APPENDIX TO  
HEARINGS  
BEFORE THE  
SELECT COMMITTEE ON ASSASSINATIONS  
OF THE  
U.S. HOUSE OF REPRESENTATIVES  
NINETY-FIFTH CONGRESS  
SECOND SESSION  
VOLUME VI  
PHOTOGRAPHIC EVIDENCE  
MARCH 1979

Printed for the use of the Select Committee on Assassinations



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Vol. 6

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# INVESTIGATION OF THE ASSASSINATION OF PRESIDENT JOHN F. KENNEDY

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\*This section is not directly relevant to any conspiracy issue, but rather pertains to the question of an Oswald alibi. See sec. III-B.





# REPORT OF THE PHOTOGRAPHIC EVIDENCE PANEL\*

## I. INTRODUCTION

(1)\*\* The events in Dealey Plaza, Dallas, Tex., on November 22, 1963, surrounding and including the assassination of President John F. Kennedy, were recorded in a substantial body of photographic evidence. More than 510 photographs that relate directly to the assassination were taken by approximately 75 photographers, in addition to substantial other relevant photographic evidence pertaining to events that did not involve the actual assassination. (1)

(2) This photographic evidence provided the Warren Commission with a basis for attempting to resolve important issues such as the number, timing, and source of the shots fired at President Kennedy. The generally poor quality of portions of the materials, however, has resulted in many interpretative questions regarding matters that the Warren Commission purported to resolve. In the years since the Warren Commission, independent researchers have criticized its findings that were based upon photographic evidence as incomplete and unsubstantiated. (2)

(3) It is clear that the Warren Commission's investigation was limited for a number of reasons:

(4) 1. It did not have access to all critical photographic materials, such as those from the autopsy;

2. Potentially important photographs were not located;

3. The Commission did not have its own investigators and analysis, but had to rely on other Government agencies, thereby bringing the credibility of its report, if not the quality, into question; and

4. Photographic enhancement technology was not as sophisticated or effective in 1963-64 as it has since become.

(5) In contrast, the House Select Committee on Assassinations, because of the independent status established by its congressional mandate, was able to select its own panel of photographic experts who had access to files and photographic records that, for one reason or another, were not available to the Warren Commission. The committee was also able to secure access, and have its panel review, independent studies that had been conducted in the years since the Warren Commission.

(6) The sciences associated with photography have been advanced significantly in recent years. New processes in chemistry and radio chemistry and new films make possible great sensitivity to changes in the light and dark tones of an image and in the recording of small details. (3) Another important development has been the use of com-

\*Materials submitted for this report by the photographic panel were compiled by HSCA staff members Michael Goldsmith and Jane Downey.

\*\*Arabic numerals in parentheses at the beginning of paragraphs indicate the paragraph number for purposes of citation and referencing; italic numerals in parentheses in the middle or at the end of sentences indicate references which can be found at the end of this report.

puter technology for the enhancement of photographic picture quality. (4)

(7) Accordingly, the panel was ultimately expected to apply, within the given time and monetary constraints, the most sophisticated photographic technology available to resolve outstanding issues related to the photographic evidence. These issues included the number, timing, and source of the shots, the identification of the murder weapon(s), the identity of the assassin(s) and possible coconspirators, the authentication of both the Kennedy autopsy materials and several incriminating photographs of Oswald with the alleged murder weapon, and the validity of the "second Oswald" theory.

### *A. Selection of the Photographic Experts*

(8) Early in 1978, after consulting officers and members of the American Society of Photographic Scientists and Engineers, the committee convened a panel of experts with varied backgrounds in the photographic sciences to study the available photographic evidence related to the assassination and to advise on the newest analytical and scientific procedures which could be effectively applied.\* The panel included a broad range of technological expertise, covering such diverse areas as photographic image enhancement, photogrammetry, photointerpretation, and forensic photography.\*\* The photographic evidence panel was composed of the following individuals:

Harry C. Andrews, Ph. D., Image Processing Institute, University of Southern California, Los Angeles, Calif.

Richard J. Blackwell, B.S., M.S., Jet Propulsion Laboratory, Pasadena, Calif.

Thomas N. Canning, B.S., M.S., National Aeronautics and Space Administration, Moffett Field, Calif.

Robert Chiralo, B.S., M.S., the Aerospace Corp., Los Angeles, Calif.

David B. Eisendrath, B.A., consultant in technical and scientific photography, Brooklyn, N.Y.

Ronald Francis, Ph. D., School of Photographic Sciences, Rochester Institute of Technology, Rochester, N.Y.

William K. Hartmann, B.S., M.S., Ph. D., senior scientist, Planetary Science Institute, Tucson, Ariz.

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\*Initially, an effort was made to limit membership on the photographic evidence panel to individuals who had never done any work for the U.S. intelligence community. Nevertheless, after spending weeks contacting various photographic specialists, it became apparent that most of the leading photographic scientists in this country have done some intelligence-related work. Accordingly, a previous affiliation with an intelligence agency was not considered to be an automatic basis for precluding someone from membership on the panel.

\*\*Each of these terms has a particular meaning or technical trade usage among photographic scientists. The terms have been defined in the "Dictionary of Contemporary Photography" (L. Stroebel and H. N. Todd, Morgan & Morgan, Inc., publishers, Dobbs Ferry, N.Y. 1974) :

*Forensic photography*—The specialization of making photographs for law enforcement or related purposes.

*Image enhancement*—Any process by which a photographic record is improved, as by increase in sharpness or contrast, or by reduction in noise.

*Photogrammetry*—The technology of using photographic methods to make accurate measurements. The term, initially applied to aerial surveying and cartography, et cetera, has been extended to include other types of mensuration, even to photographic methods of fitting garments to a person. Also see photometry.

*Photointerpretation*—The process (usually visual) of obtaining qualitative or quantitative information from a photograph. The term initially had a military connotation but has been extended to other areas, such as geodetic, agricultural, climatic, and population studies.



- Bob R. Hunt, B.S., M.S., Ph. D., professor, systems and industrial engineering and optical sciences, University of Arizona, Tucson, Ariz.
- Donald H. Janney, Ph. D., Los Alamos Scientific Laboratory, University of California, Los Alamos, N. Mex.
- Ellis Kerley, B.S., M.S., Ph. D., chairman, department of anthropology, University of Maryland, College Park, Md.
- Sgt. Cecil W. Kirk, Mobile Crime Lab, District of Columbia, Metropolitan Police Department.
- Charles J. Leontis, B.S., M.S., the Aerospace Corp., Los Angeles, Calif.
- C. S. McCamy, B.C.E., M.S., vice president, science and technology, Macbeth Division, Kollmorgen Corp., Newburgh, N.Y.
- Gerald M. McDonnel, M.D., department of radiology, The Hospital of the Good Samaritan, Los Angeles, Calif.
- Everett Merritt, retired scientist in analytical photogrammetry, geodesy, and astrophysics, Ridge, Md.
- Paul G. Roetling, B.A., Ph. D., principal scientist, image processing area, Xerox Corp., Rochester, N.Y.
- Frank Scott, B.S., M.S., the Perkin-Elmer Corp., West Redding, Conn.
- Robert H. Selzer, B.S., M.S., M.A., Jet Propulsion Laboratory, Los Angeles, Calif.
- Bennett Sherman, B.S., M.S., consultant on optics and allied sciences, Elmhurst, N.Y.
- Philip N. Slater, B.S., Ph. D., professor, optical sciences, University of Arizona, Tucson, Ariz.
- Clyde C. Snow, B.S., M.S., Ph. D., Chief, Physical Anthropology Division, Civil Aeromedical Institute, Federal Aviation Administration, Oklahoma City, Okla.
- George W. Stroke, B.S., Ph. D., former professor of medical biophysics and electrical sciences at Harvard University and State University of New York, Stony Brook, N.Y.

### *B. Image Enhancement Technology\**

(9) Three types of enhancement technology were available to the panel.

#### 1. PHOTO-OPTICAL/PHOTOCHEMICAL ENHANCEMENT

(10) The recording of a photographic image involves the optical and chemical properties of halide salts of silver. Silver halides, such as silver bromide, silver chloride, or silver iodide, are sensitive to light. Light falling on small grains of these salts makes the silver compounds reactive to other compounds known as developers. During the film development process, a developer separates the silver atoms from the halide atoms (for example, bromine, chlorine, et cetera), which can be washed away by other compounds, leaving an image or picture made up of the remaining grains of silver. (5)

(11) Thus, every photographic image is recorded by microscopic silver grains. The presence of these grains is directly a function of light, since light is required to change the silver halide compound so that it may be acted upon by the developer. Where no light falls upon the film, little or no silver will be deposited by the process of development. Where much light falls on the film, much silver will be deposited. The relation between the amount of light and of silver grains results in the creation of a photographic negative or image. The image is referred to as a negative because the regions of the film with little silver appear light, while those with much silver appear dark, even though the regions respectively correspond to dark and bright portions of the object photographed.

(12) Color photography is a simple extension of the process involved in black and white photography. A color photograph has three separate layers of silver grain. Each is sensitive to only one particular

\*This section prepared under the direction of Bob R. Hunt.

primary color of light, a property achieved by color filtering compounds intermixed with the layers of grain. One layer might respond only to red, a second to green, a third to blue. Since all secondary colors can be composed from a proper mixture of these three primary colors, the film can record any color of light. In the color development process, the silver grains are replaced by color dyes, and the primary colors of the layers combine to form the true image colors.

(13) The visual qualities of a photographic image are governed by the physical and chemical properties of the constituents in the photographic process, for example, the actual silver halide compound used, the size of the silver halide grains and the distribution (from smallest to largest) of the sizes of the grains, the chemicals used for development, and the time and temperature at which development is carried out. Once a developed photographic image has been produced, the image carried by the silver grains is fixed within the developed piece of film.

(14) Other photographic processes can be used to amplify differences in deposited silver that are faint in the original film. The extent to which an image feature can be visually detected is associated with contrast, which is related to the difference between the brightest and darkest portions of an image. (6) Features with low contrast, that is, with small differences between the maximum and minimum deposition of silver grains, are difficult (or impossible) to detect visually. However, if differences do exist, it is possible to use photographic materials and processes to enhance them.

(15) Photo-optical and photochemical enhancement may be used to improve image contrast. This type of enhancement employs high contrast photographic materials and processes, that is, materials and processes which amplify low-contrast details, making greater the differences between bright and dark portions of the image so that they become visible. The experienced photographer often refers to these techniques as "darkroom exercises," because an enhanced copy of the original image is produced in the darkroom by selection of photographic materials, exposure time, and development chemistry.

## 2. DIGITAL IMAGE PROCESSING

(16) Digital image processing is the use of a digital computer to manipulate an image. When successful, this process may be used to clarify images by removing blur and altering contrast. The actual type of computer manipulation chosen depends on what is to be achieved. For example, computer enhancement of image detail requires a different computer process than that for measuring object dimensions.

(17) There are three important phases in computer image processing: (1) Image sampling and quantization; (2) computer processing of the image samples; and (3) re-creation of an image from the computer's output. (7)

(18) Sampling and quantization is the process of converting an image into computer numbers. An image is a representation of visible light, whereas a computer works with numbers. The visible light representation of an image must be converted into numbers of the kind used by the computer. This is done by a device generically referred to as a sampler/quantizer; as applied in this process, it is known as a scanning microdensitometer.



## Simple Diagram of Computer Scan of Image

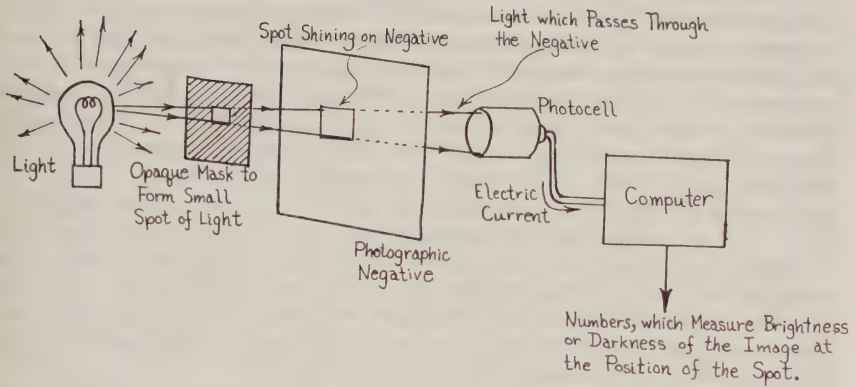


FIGURE I-1

(19) Figure I-1 (JFK exhibit F-149) is a schematic diagram of the sampling/quantization process. A small spot of light is projected onto a photographic transparency image. Light passes through the image at the position of the spot and is collected by a photocell. The amount of light collected is directly proportional to how dark or light the transparency is at that position. The collected light causes an electric current to flow; its strength is directly proportional to the strength of the light which passes through the image. The electric current is measured by the computer, which breaks the current into a discrete number of intervals and assigns a number, or value, for the amount of current in each interval.

(20) For example, the computer might divide an electric current, ranging from zero to a maximum of "I" amps,\* into 1,000 intervals. If the current, when measured, falls into the 350th interval between zero and "I" amps, then the computer would assign the number "350" to that image brightness. By moving the light spot over the entire image, it is possible to extract all the important information. The actual number of samples which must be extracted is governed by a specific mathematical relation which depends on the content of the image. (8)

(21) The colloquial interpretation of sampling implies a partial

\*Amps is the conventional abbreviation for amperes, the international standard for measurement of electric current. By convention, "I" symbolizes an unspecified amount of electric current.

extraction of information. Nevertheless, engineering usage of the term implies extraction of all relevant information; mathematical theorems prove that proper sampling does, in fact, extract all relevant information. In the context of digital image processing, the term sample refers to the size of the image area that is scanned by the microdensitometer. Thus, if there is a lot of information content (that is, in terms of small detail and fine structure), the samples (that is, areas scanned on the film) must be closely spaced and a large number will be required; if there is not a lot of information content, the samples need not be as closely spaced and a smaller number will be needed. Given typical processing conditions and common camera and film combinations, a matrix of samples ranging in size from 100 by 100 to as many as 1,000 by 1,000 samples or even more will be extracted.

(22) Color images can be sampled and quantized in the same way. The sampling must, however, be repeated three times; each repetition is carried out with a colored filter in the optical path of the microdensitometer. The proper choice of filters (for example, red, green, blue) leads to measurements of relative color strengths which make it possible to recreate any arbitrary color in the image.

(23) After sampling and quantization, the numbers that represent the image are run through a computer. A specific computer operation is selected on the basis of a mathematical model. The physical processes that took place in the creation of the photographic image can be described by mathematical equations. Even processes that resulted in an undesirable degradation of image quality can be described by such models. The numbers measured in the sampling and quantization process represent actual numerical values of the mathematical variables of the model.\* The computer is used to solve the equations of the mathematical model, and the solution of the equations will be the numerical representation of an image that has been enhanced in some fashion. The actual type of enhancement will depend, of course, on the particular mathematical model used. (9)

(24) The third and final phase is to recreate an image from the numbers representing the enhanced image. There are two basic methods for recreating an image: hard copy and soft copy.

(25) Hard-copy image display can be exemplified by a system similar to the schematic diagram shown in figure I-1 (JFK exhibit F-149). The spot of light, its brightness converted by the computer according to the value of numbers corresponding to each image spot, is run over a piece of unexposed photographic film. When the film is developed, an image emerges, composed of all the small individual spot exposures. This method is known as hard copy because it produces a tangible item, the piece of developed film.

(26) In soft-copy display, the numbers in the computer are transmitted into a special computer memory, that can be used to position a spot of light on the face of a television display tube. The actual position of the light spot and its brightness will depend both on the particular computer memory location and the number occupying that location. By rapidly and repeatedly reading the numbers from the memory and writing light spots on the TV display, a display of the image is

---

\*A mathematician would say that the measured image's numerical values are "substituted" into the equations of the model.

created. It is similar to the image on a home television set, but is of far superior image quality to any home television display.

(27) Computer displays are referred to as soft copy because the image is transient on the face of the television display rather than a permanent thing. Computer soft-copy displays have a distinct advantage over hard-copy displays. The image is created from the contents of the computer's special memory, that can be altered by the computer. Any such change in the image is instantly visible on the screen. The image analyst can use this instant display of results to interact directly with the computer to produce mathematically an enhanced image with the most desirable visual qualities. Each of the three digital image processing facilities employed by the committee possessed interactive soft-copy display equipment, which played an important role in the creation of enhanced imagery for the Panel.

(28) It is important to understand the differences in effect between hard-copy and soft-copy methods of image display. Hard-copy displays are not as effective because they may suffer from degradation. A soft-copy display can produce a more brilliant image with a wider dynamic range than can a hard-copy display, i.e., the difference between darkest and brightest regions of the image will be greater. If color imagery is involved, the fidelity of color representation is more accurate in a soft-copy display. Unfortunately, the permanent visual results of an image enhancement process can be recorded only on a hard-copy display.\* The quality of hard-copy displays reproduced in this report may be less than that of the soft-copy displays used by the Panel and contractors in their analysis and deliberations; the final conclusions of the Panel, however, were based on the best possible image displays, and not on the displays reproduced in this report.



FIGURE I-2.—Computer Contrast Enhancement.

29) Figure I-2 (JFK exhibit F-150) shows the type of image enhancement that may be achieved by an interactive soft-copy display. The original image, shown on the left, is of extremely low contrast, that is, the maximum and minimum brightnesses of the image are

\*The computer tape storing the numerical values that have been assigned to the image samples can also be permanently retained, but this, of course, is not an actual visual record.



virtually the same; little detail is visible. Using an interactive display, the range of contrast was greatly expanded to produce the enhanced image shown at the right of the exhibit. The result is a dramatic improvement. (The "contrast" control on a home television receiver expands contrast in a similar way; however, a computer-controlled contrast expansion has much more flexibility than does a television receiver.)

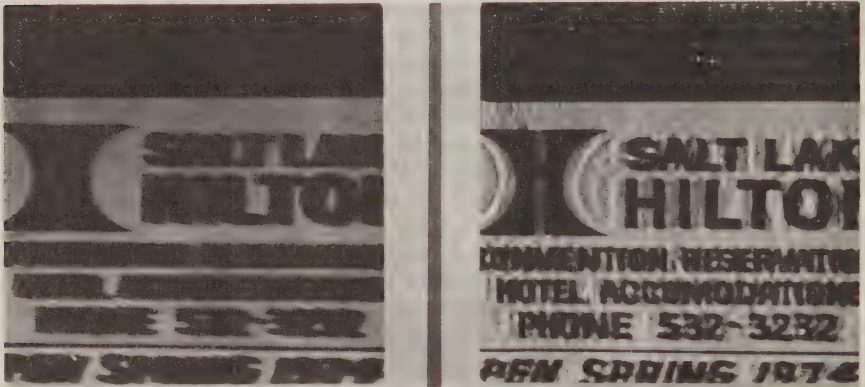


Figure I-3.—Successful Image Deblurring.

(30) Figure I-3 (JFK exhibit F-151) shows the different kind of enhancement that may be achieved with digital image processing. The photograph at the left was taken by a camera that was moved while the shutter was open. The sign is badly blurred, and most of its fine detail has been lost. The objective in enhancing this image is to minimize the effects of the blur.

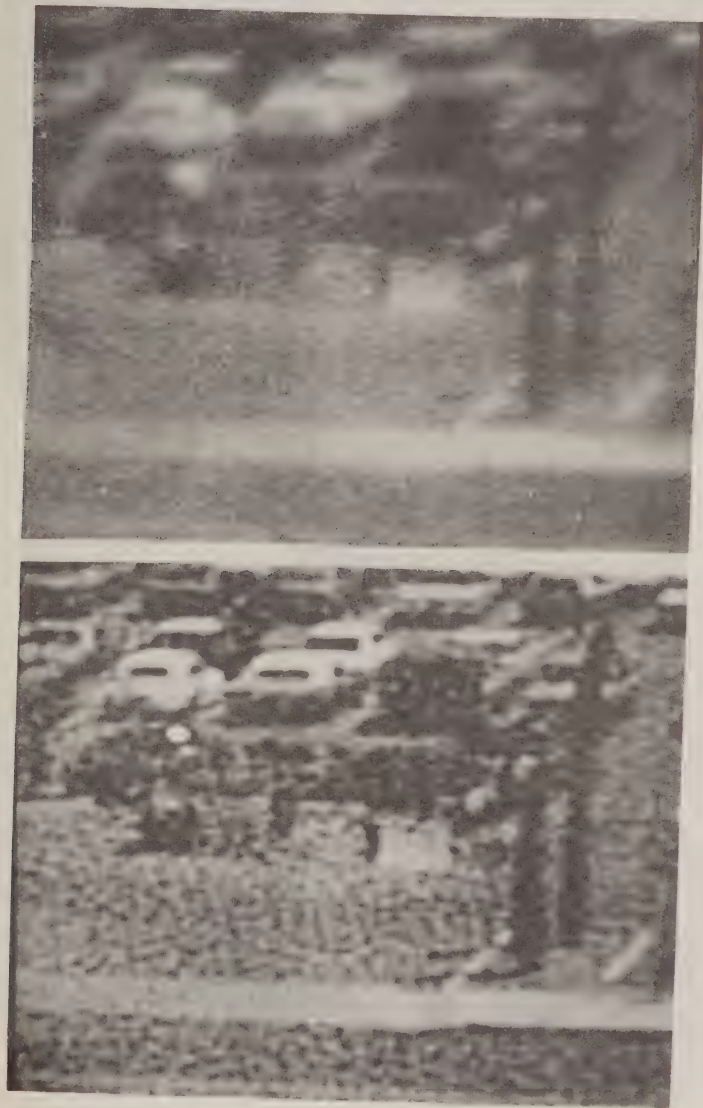
(31) Removing an image blur after the picture is recorded on film is a process that has been extensively studied in recent years. The basic principle can be summarized as follows. The blurred image that is recorded on film can be represented by an image formation equation as being the result of an ideal (or unblurred) image that has been degraded by blur. (10) If the image formation equation can be solved for the ideal or unblurred image, then an image is produced which has had the blur removed. Solving the image equation requires the solution of hundreds of thousands (sometimes millions) of algebraic equations. The magnitude of this process made it impossible to carry out until the introduction of new computing algorithms in the 1960's and the availability of large scientific computers.

(32) The image at the right in figure I-3 (JFK exhibit 151) shows the result of deblurring by this process. The increased legibility of fine detail and letters is dramatic when compared with the original.

(33) The process of image deblurring can be so dramatic that it is frequently misinterpreted as a magical "cure-all." There are fundamental limitations, however, on the extent to which a blur can be removed. These limitations are due to what is called "noise." Anyone who has lived in a "fringe-area" for television reception has seen noise in an image: the speckled or "salt-and-pepper" graininess visible in a weak television image (colloquially referred to as "snow") is the

result of random fluctuations in the weak electronic TV signal. Noise represents random uncertainties in the values of the image and is not attributable to any particular cause.

(34) Since these image values are used to solve the equations to produce a deblurred image, uncertainties or inaccuracies in these values lead to errors or inaccuracies in the solution. The more noise present in a blurred image, the more unsuitable a deblurred image will be. Figure I-4 (JFK exhibit F-152) illustrates this situation.



**FIGURE I-4. Unsuccessful Image Deblurring**

The original image on top is blurred and very noisy. The deblurred image on the bottom shows virtually no improvement in image quality due to the limitations imposed by noise.

## 3. AUTORADIOGRAPHIC ENHANCEMENT

(35) Autoradiographic enhancement involves the use of a radioactive chemical to achieve enhancement of image contrast rather than the removal of image blur. (11) Autoradiographic enhancement is applicable only to black and white films.

(36) As noted earlier, a photographic image is created by the deposition of minute silver grains. A minimum number of grains must be deposited for the image to be visible. Any weak light falling on a piece of film will cause some deposition of silver grains, but the number may be too small for interpretation. Autoradiographic enhancement tries to strengthen this weak image.

(37) This is attempted by bathing the film containing the weak image in a radioactive chemical that binds to silver, thereby making every silver grain a source of radioactivity. The radioactive film is placed in contact with a piece of X-ray film, which is exposed by the radioactive silver grains. The longer the X-ray and radioactive films are in contact, the greater the radioactive exposure of the X-ray film. When the X-ray film is developed, even very small numbers of silver grains in underexposed areas of a film will be made visible.



# SRI INTERNATIONAL AUTORADIOGRAPHIC ENHANCEMENT OF PHOTOGRAPHIC IMAGES



(a) AERIAL PHOTOGRAPH, UNDEREXPOSED BY A FACTOR OF 12



(b) AUTORADIOGRAPHIC INTENSIFICATION OF AERIAL SCENE  
SHOWN IN (a)

Type R x-ray film, 48-hr exposure.

(38) Figure I-5 (JFK exhibit F-154) illustrates the application of the autoradiographic enhancement procedure. The original image is severely underexposed; there was only one-twelfth as much light as was needed to expose the negative properly. The enhanced image is the result of the autoradiographic technique.

### *C. Source Materials for Enhancement*

(39) Image enhancement can result in dramatic photographic clarification, but the extent of improvement is limited by the quality of the original images. That is, an image may be so severely degraded that no combination of enhancement techniques can improve it. One parameter already mentioned that limits enhancement is image noise.

(40) Any photographic copying process will introduce some noise into a copy. In most cases, this new noise will not be detrimental. Moreover, in general, there are so many other potential difficulties in image copying such as loss of sharpness and resolution, loss of contrast, and loss of gray tones that it is undesirable to attempt to enhance these copies. The Panel made a decision to work only with original images for enhancement.

(41) The Panel also adopted a policy of working with transparency images as much as possible as distinct from prints that are on an opaque base. An important property of any image is the dynamic range of values of brightness from smallest to largest. Given a certain level of photographic noise, an image with a wide dynamic range is preferable to one with a narrow dynamic range because the accuracy of brightness representation increases as the dynamic range increases. In effect, the wider the dynamic range, the less interference is occasioned by image noise. Because under proper processing the dynamic range of images recorded on transparency film is much greater than with opaque film (for example, photographic print paper), transparency film images are preferable as source material for image enhancement.

(42) Following is a list of the most important original (unless otherwise indicated) photographic materials studied for possible enhancement and analysis purposes. Each item is identified by its photographer's name:

1. Oswald "backyard picture" materials (for list of items, see paragraphs 366-370, *infra*.)

2. Kennedy autopsy photographs (color and black and white), transparencies and X-rays.

3. Color photographs:

Wilma Bond  
\*Robert Croft  
James Powell

Jim Towner  
Phillip Willis

4. Black and white photographs:

William Allen  
James Altgens  
\*Jack Beers  
\*Hugh Betzner  
Richard Bothun  
\*Tom Cablack  
\*Frank Cancellare  
\*Malcolm Couch (movie  
stills)

Tom Dillard  
\*Joe Laird  
Mary Moorman  
\*Jim Murray  
Arthur Rickerby  
\*George Smith  
\*George Weaver  
\*David Weigman (movie  
stills)

## 5. Motion picture films:

\*Thomas Alyea

Mark Bell

Dallas Cinema Associates combined sequences taken by 18 photographers, including John Martin and Charles Mentensana; for others see H. Weisberg, *Photographic Whitewash: Suppressed Kennedy Assassination Pictures* (published by author, 1967), p. 254.

Elsie Dorman

\*Patsy Paschell

Robert Hughes

Tina Towner (Barnes)

Marie Muchmore

Abraham Zapruder

Orville Nix

NOTE: Initially, Robert Groden, a photographic consultant to the committee advised the panel as to pertinent photographic issues and related materials. Committee investigators located many of the suggested films and photographs, however, some items were never located, i.e. the Babushka Lady film, a color photograph by Norman Similas, and the original negative of the Betzner photograph.

*D. Panel Procedures*

(43) The Photographic Evidence Panel was responsible for establishing the guidelines and procedures under which all of the committee's photographic enhancement and analytic work was to be accomplished. Because of the large quantity of material to be examined, it contracted with several laboratories to perform, under its general direction, all necessary photographic enhancement work and, on occasion, some analytic work as well.

(44) Photo-optical/photo-chemical enhancement was undertaken by a team of professors at the Rochester Institute of Technology, and digital image processing was performed by the University of Southern California Image Processing Institute, the University of California Los Alamos Scientific Laboratory and The Aerospace Corp. Once these contractors had completed their work, the results were submitted to the Panel for interpretation and its own independent analysis.

(45) The Photographic Evidence Panel first met with the committee and representatives of the laboratories in February 1978. At that time, the Panel was apprised of the issues that the photographic evidence touched upon, and assigned the overall task of examining the photographic material compiled by the committee.

(46) After the Panel had reviewed these materials, enhancement and analytic projects were outlined and assigned to the laboratories. Analytic studies were also assigned to individuals and groups within the Panel, according to their respective specialties. The work was conducted with periodic reviews by the Panel, between February and mid-July, when the Panel held its final conference to evaluate all the results.

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\*Copy prints.



## II. THE NUMBER, TIMING, AND SOURCE OF THE SHOTS FIRED AT THE PRESIDENTIAL LIMOUSINE

### *A. Warren Commission Findings*

(47) The Warren Commission concluded that three bullets had been fired at the Presidential limousine from the sixth floor, southeast corner window, of the Texas School Book Depository. Finding that the first pierced the President's neck, the Commission also indicated that "[a]lthough \* \* \* not necessary to any essential findings \* \* \*, there is very persuasive evidence from the experts to indicate that [this] \* \* \* same bullet \* \* \* also caused Governor Connally's wounds." (12) A second bullet caused a massive and fatal wound to the President's head; (13) a third bullet was believed to have missed the car and its occupants. (14)

(48) The Commission was unable to establish conclusively which of the three bullets missed, and hence the precise timespan of the shots was not definitively determined. By studying the Zapruder movie film, it found that the President's back wound occurred between frames 210 and 225, and that the head wound occurred at frame 313. (15) Based upon the 18.3 frame-per-second average rate of speed at which film was exposed in Zapruder's camera, the Commission then calculated that "there was an interval of from 4.8 to 5.6 seconds" between those two shots. (16) If the second bullet were the one that missed, then this interval was the timespan for all the shots. If, however, either the first or third bullet missed, the minimum timespan would have been 7.1 to 7.9 seconds (derived from the previous calculation of 4.8 to 5.6 seconds plus 2.3 seconds, the minimum time in which Oswald's Mannlicher-Carcano rifle could be fired). (17)

(49) To support its conclusion that the President's and Governor's wounds were caused by shots that were fired from the sixth floor, southeast corner window, of the Texas School Book Depository, the Warren Commission relied on an FBI reenactment. Using the Zapruder film as the point of reference, the FBI placed the limousine and its occupants in their approximate positions at the time of the shots and then determined the angle from the wound entry point on President Kennedy to "the end of the muzzle of the rifle positioned where it was believed to have been held by the assassin." (18) The average resulting angle of  $17^{\circ}43'30''$ , allowing for a downward street grade of  $3^{\circ}9'$ , was concluded by the Commission to be "consistent with the trajectory of a bullet passing through the President's neck and then striking Governor Connally's back \* \* \*." (19)

(50) Although each of these findings has been criticized, the Commission's statement that the bullet which caused President Kennedy's neck injury was also responsible for Governor Connally's wounds has caused the most controversy. Warren Commission critics have asserted that in the Zapruder film, Governor Connally first reacts to his wounds at frames 234 or 238, 0.5 to 1.5 seconds after the President (who the

Commission found was struck between frames 210-225) and, therefore, could not have been hit by the same bullet. Moreover, given the 2.3-second minimum firing time for a Mannlicher-Carcano rifle, they assert that another gunman must have been involved in the assassination. (20)

(51) Critics have also questioned the Commission's "single bullet theory" because they find that, given the wounds, the relative alinement of the President and the Governor within the limousine was inconsistent with the path of a single bullet. (21) They claim that the Commission's trajectory analysis was self-serving, since it assumed a particular location for the gunman and then merely sought to verify that the angle from rifle muzzle to the limousine occupants was consistent with the trajectory of a bullet passing through the two men.

### *B. The Panel's Analysis*

#### 1. APPROACH

(52) In an effort to determine the number, timing, and source of the shots that were fired at the Presidential limousine, the Photographic Evidence Panel conducted the following studies:

(53) (a) The Zapruder film was studied for evidence of reactions to gunshots by both the limousine occupants and Dealey Plaza witnesses, and to determine whether the relative alinement of John F. Kennedy and John B. Connally within the limousine was consistent with the single-bullet theory. Still photographs pertinent to the single-bullet theory controversy were also reviewed;

(54) (b) The blurs in the Zapruder film were analyzed to determine if they could be attributed with precision to the cameraman's reflex reaction to the sound of gunshots;

(55) (c) A trajectory analysis was conducted under the direction of an aerodynamics engineer from NASA; and

(56) (d) Photographs of the Dealey Plaza environs in which it has been alleged that gunmen can be seen were subjected to photographic enhancement and analysis.\*

#### 2. VISUAL EVIDENCE DERIVED FROM OBSERVATIONS OF PERSONS IN THE ZAPRUDER FILM\*\*

##### *(a) Issues*

(57) The Panel was requested by the committee to address, at a minimum, three questions:

(58) (a) When did Kennedy first show a reaction to some severe external stimulus?

(59) (b) When did Connally first show a reaction to some severe external stimulus?

(60) (c) Was the relative alinement of Kennedy and Connally within the limousine consistent with the single-bullet theory?

\*The results of this study are discussed at ¶241-346, *infra*.

\*\* This section prepared under the direction of C. S. McCamy, Frank Scott and Bennett Sherman. For the related public hearing testimony of C. S. McCamy, 1/12/78, see HSCA-JFK Hearings, vol. II, pp. 142-54, 349-72.



*(b) Materials and procedures*

(61) The Zapruder film was studied with care at each of the panel's conferences.<sup>1</sup> At the final conference, which took place in July 1978, the film was closely scrutinized by more than 20 photographic scientists who were either members of the Panel or contractors responsible for much of the committee's laboratory work (i.e., photographic enhancement, restoration, etc.). At the Panel's request, a specially enhanced version of the Zapruder film had been obtained which stabilized and enlarged the images of Kennedy and Connally. The Panel was also given access to four frames which showed the Presidential limousine going behind a sign; these had previously been spliced out of the original Zapruder film.<sup>(22)</sup> Finally, computer assisted enhancements of relevant frames from the Zapruder film were made available to Panel members, but these were not reviewed until later.

(62) In total, the Zapruder film was viewed by this group on a frame-by-frame basis and at various speeds approximately 100 times.<sup>2</sup> A special analytical projector was used to facilitate this task. Because the quality of most of this film generally precluded analysis of facial expressions, primary emphasis was given to attempting to detect gross changes in body movements. As each frame was analyzed, proper consideration was given to the Zapruder film's exposure rate through the camera of 18.3 frames per second. <sup>(23)</sup> In this manner, changes in body movements between frames could be better understood and, at times, even quantified.

(63) After completing its review of the film the Panel took a vote with regard to each of the issues that had been raised by the committee.<sup>3</sup> The Panel's vote focused on those reactions to severe external stimuli that may have been suggestive of impacting bullets.

*(c) Conclusions*

(64) (a) By a vote of 12 to 5, the Panel determined that President Kennedy first showed a reaction to some severe external stimulus by Zapruder frame 207, as he is seen going behind a street sign that obstructed Zapruder's view.

(65) (b) By a vote of 11 to 3, the Panel determined that Governor Connally first showed a reaction to some severe external stimulus by Zapruder frame 224, virtually immediately after he is seen emerging from behind the sign that obstructed Zapruder's view.

(66) (c) By a vote of 15 to 1, the Panel determined that the relative alinement of President Kennedy and Governor Connally in the limousine was consistent with the single bullet theory.

(67) (d) At least two shots, spaced approximately 6 seconds apart, were fired at the Presidential limousine. Nevertheless, based only on

<sup>1</sup> For references to Zapruder frames discussed herein, see JFK exhibits F-209-274, HSCA-JFK Hearings, vol. I, pp. 69-97.

<sup>2</sup> It is difficult to state this figure with precision because various segments of the film were continuously replayed while others received considerably less attention.

<sup>3</sup> Because the film was not viewed simultaneously by all participants, some of whom occasionally had to leave the room to perform other tasks, and as the voting was conducted at different times for each issue, the same number of votes was not cast on each issue.



its review of the reactions of persons shown in the Zapruder film, there was insufficient evidence to reach any conclusion concerning additional shots.

(d) *Analysis*

(68) The first reaction by any of the limousine occupants to a severe external stimulus begins to occur in the vicinity of Zapruder frames 162-167.\* At this time, Connally is looking to his left, when his head begins a rapid, sudden motion to the right. In quantitative terms, he turns his head approximately  $60^\circ$  to his right in one-ninth of a second (a rate equivalent to a  $540^\circ$  rotation per second). He pauses momentarily and then executes a further  $30^\circ$  turn to his right, within an eighteenth of a second (again, a rate equivalent to a  $540^\circ$  rotation per second). This initial rapid motion, in which Connally has apparently turned his head to look behind him, is accompanied during the next approximately 20 frames by a more gradual  $60^\circ$  shift to the right of his upper torso. Although it is apparent that none of the limousine occupants has been shot at the time that Connally initiates this movement, the Panel considers these actions to be particularly significant because they were consistent with his Warren Commission testimony that he turned in response to having heard the first shot and was struck almost immediately afterwards. (24)

(69) During the period of Connally's initial rapid movement, however, no one else shows a comparable reaction. The President does not appear to react to anything unusual prior to Zapruder frame 190. The Panel observed, however, that at approximately this time, a young girl who had been running across the grass, beyond the far curb of the street where the limousine was traveling, suddenly began to stop and turn sharply to her right, looking up the street in a direction behind the limousine.

(70) At approximately Zapruder frame 200, Kennedy's movements suddenly freeze; his right hand abruptly stops in the midst of a waving motion and his head moves rapidly from right to his left in the direction of his wife. Based on these movements, it appears that by the time the President goes behind the sign at frame 207 he is evidencing some kind of reaction to a severe external stimulus. By the time he emerges from behind the sign at Zapruder frame 225, the President makes a clutching motion with his hands toward his neck, indicating clearly that he has been shot.

(71) Connally's movements as he emerges from behind the sign at Zapruder frames 222-224 also indicate that he is reacting to a severe external stimulus. He appears to be frowning, and there is a distinct stiffening of his shoulders and upper trunk. Then there is a radical change in his facial expression, and rapid changes begin to occur in the orientation of his head.

(72) In the subsequent frames, Kennedy and Connally appear to show simultaneous, reaction-type movements. There is less than a three-frame (0.16 second) delay in their movements.

(73) At frame 313, approximately 6 seconds (based on the 18.3 frames per second exposure rate of the Zapruder camera) after the

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\*Because this reaction was not perceived as a response to an impacting bullet, it was not adopted as one of the panel's conclusions.

President disappears behind the sign, his head is seen exploding from the impact of a bullet.

(74) Having noted the virtually simultaneous reactions displayed by Kennedy and Connally, the Panel proceeded to consider whether the two men's relative alinement in the limousine was consistent with the single-bullet theory. In this regard, the President is observed, between frames 170-190, to be sitting well to the right side of the limousine. Specifically, his right arm is extended over the chrome strip that runs along the side of the limousine. Governor Connally's rightward body orientation is clearly seen during these same frames. His body is situated much more toward the center of the limousine, as demonstrated by the amount of the rear seat that can be seen between President Kennedy and Governor Connally.

(75) This visual analysis was confirmed stereoscopically when computer enhancements of Zapruder frames 187 and 193 were examined in three dimensions as a stereo pair. Pairs of photographs, taken moments apart, may on occasion be viewed in a manner that gives rise to a three-dimensional image. When this occurs, the photographs are said to constitute a stereo pair.

(76) Stereoscopy may be explained as follows: Because human eyes are a short distance apart, each sees a slightly different aspect of any object within a distance of about 50 feet. These slightly different visual images are interpreted by the brain as clues to the relative distances of various parts of the object. This is called "stereopsis" or "stereoscopic vision." The two eyes see a single near object alined with different distant objects. This is known as parallax. This effect also contributes to the perception of depth.

(77) If two photographs are taken of the same nearby still scene and the camera is moved horizontally about 3 inches between the two exposures, the camera will record what would have been seen by two eyes (spaced about 3 inches apart), had they been in the same two places as the camera had been. When these photographs are viewed separately (so that one eye sees one photograph and another eye sees the other) by means of an optical device called a "stereoscope" or "stereo viewer," the visual system and the brain interpret the scene in depth, just as though the original scene were being viewed directly.

(78) The identical effect can be achieved with individual frames of a motion picture film such as the one taken by Zapruder. A motion picture film consists of a series of still photographs. A slight movement of the camera (that is, by about 3 inches) can result in individual frames being viewed as stereo pairs. In addition, even if the camera is held relatively still, a similarly slight movement by the object may give rise to stereo pairs of photographs. This is because, in relative terms, the effect is that of the camera moving in relation to a still object.

(79) When this technique was applied to the Zapruder film, the relative depth of Kennedy and Connally within the limousine could be carefully examined. On this basis, their relative alinement was found to be consistent with the single-bullet theory.

(80) The panel's conclusion of the relative alinement of the two men received further corroboration by an examination of still photographs and individual Zapruder frames.\* It is further supported by the trajectory analysis described in the following section.

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\*In this regard, the Panel adopts the analysis set forth in ¶ 158-165 *infra*.



## 3. THE PANNING ERROR—BLUR ANALYSIS OF THE ZAPRUDER FILM\*

*(a) Issues*

(81) (a) Can any of the panning errors indicated as blurs or "jiggles" on the Zapruder film reasonably be attributed to the photographer's involuntary startle reaction to the sound of gunshots?

(82) (b) If so, is it possible to determine from such panning error blurs the number, and to estimate the timing, of the shots that were fired at the Presidential limousine?

*(b) Procedures and materials employed*

(83) Originally, a blur study of the Zapruder film was to involve an analysis of not only the Zapruder, but also the Nix and Muchmore films, to determine whether startle reactions by the photographers were present and simultaneous for each photographer. Nevertheless, neither the Nix nor Muchmore films included any extensive footage prior to the time of the head shot. Thus, only the Zapruder film, which showed the entire motorcade scene immediately prior to and during the assassination, was subjected to this analysis.\*\*

(84) The measurement of blur, or jiggle, essentially involved a measure of Zapruder's error in panning his camera as he filmed the Presidential limousine. Two sets of measurements were made independently by Photographic Evidence Panel members William Hartmann and Frank Scott. Hartmann measured the length of images of small highlights on the Presidential car in each frame; these were generally small and round on the sharpest frame but highly elongated on frames that were blurred by camera motion during the time that the shutter was open. The amount of elongation was measured to determine the panning error. (See fig. II-1.)

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\*This section prepared under the direction of William K. Hartmann. For Dr. Hartmann's related public hearing testimony, 9/11/78, see HSCA-JFK Hearings, vol. II, pp. 4-16.

\*\*In addition, the Nix and Muchmore films were taken from a distance of about 2.7 and 2.1 times, respectively, further away from President Kennedy than the Zapruder film.



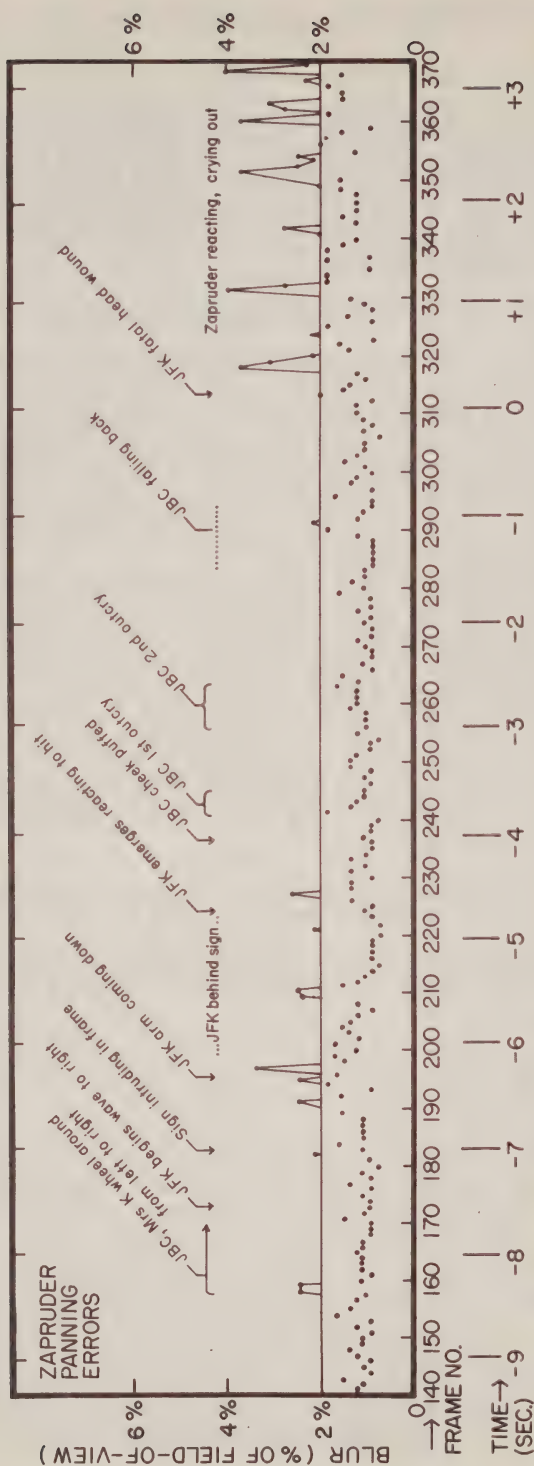


FIGURE II-1.—Amount of blur on each frame of Zapruder film as measured by W. K. Hartmann. Blur (elongation of images) is presented in terms of percentage of width of a whole frame. Large blurs represent jerking of camera, suggesting a startle reaction.

(85) Scott followed background details from frame to frame. These details indicated a direction in which the camera pointed during each frame. The sequence of these camera point directions would have defined a smooth, relatively straight line had the camera panned in a perfectly uniform manner (see fig. II-2, JFK exhibit F-371); discrepancies were revealed by erratic spacing of camera pointing directions (see fig. II-3, JFK exhibits F-372-373).

PANNING OR JIGGLE RECORD OF ZAPRUDER FILM

### EXPLANATION

IF ZAPRUDER PANNED HIS CAMERA PERFECTLY, THE JIGGLE RECORD WOULD LOOK LIKE THIS:

START END

IF ZAPRUDER PANNED HIS CAMERA PERFECTLY, EXCEPT FOR A RAPID MOVEMENT WHERE HE MOVED HIS CAMERA DOWNWARD, THE JIGGLE RECORD WOULD LOOK LIKE THIS:

IF ZAPRUDER PANNED HIS CAMERA PERFECTLY, AND MAINTAINED GOOD HORIZONTAL PANNING BUT DID NOT PAN SMOOTHLY, THE JIGGLE RECORD WOULD LOOK LIKE THIS:

FIGURE II-2.—Illustration of technique used by Frank Scott. If Zapruder had made no panning errors, the background points from frame to frame would have been plotted as illustrated.

## ZAPRUDER FILM

FRAMES 139-208

*Panning or Jiggle Record of Zapruder Film*

Frames 139-261

Frames 261-315

Frames 315-366

Frames 366-393

FIGURE II-3.—Actual plotting of background points from frame to frame by Frank Scott, showing Zapruder panning errors. Illustration on top, showing only frames 139-208, is enlargement of portion of illustration on bottom.



These were transformed into quantitative measurements by a vector subtraction process: A 20-frame running average of the rate of angular motion was used to predict the point where the camera should be aimed in frame  $n$ , based on the place where it was directed in frame  $n-1$ . A subtraction was then made between the  $n-1$  to  $n$  vector which should have appeared and the vector that actually did appear. This vector difference was then measured to determine the panning error between frames.

(86) The results of these measurements were then plotted to illustrate visually the times of greatest panning error in a manner similar to Figure II-1. (See fig. II-4.) In both Figure II-1 and Figure II-4, a threshold line was then drawn horizontally across the graph to separate visually the areas of greatest (i.e., unusual) blur from the "noise", or the normal panning errors that occurred throughout the filming simply because the camera was hand held. Any such threshold line, of course, must to some extent be arbitrarily placed. The extent of blur that resulted from an unusual external stimulus (e.g., a gunshot) may not, therefore, always be precisely delineated by the line. Zapruder's true startle reactions may have begun a frame or two earlier, or later, than indicated by the placement of the threshold line that was chosen, but blurs above the threshold line are well above the average.

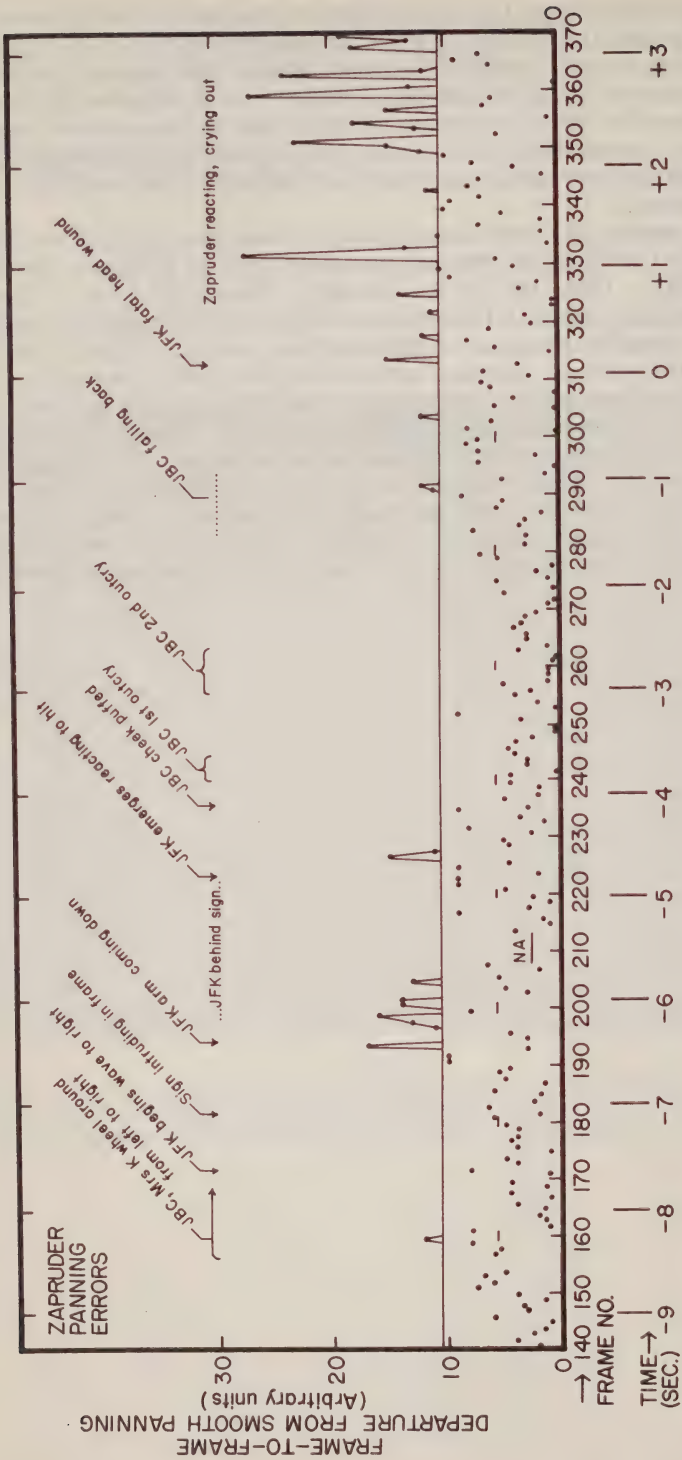


FIGURE II-4.—Errors in smooth tracking, as measured from one frame to another by Frank Scott. (Measures were reduced from Scott's graphs to numerical measures presented here by W. K. Hartmann, by method described in text.)

(87) Following our measurement of blur by these two different methods of the panning errors, the results of Luis Alvarez' study, reported in the *American Journal of Physics*, vol. 44, p. 813 (1976), were also reviewed. Instead of measuring the blur itself, Dr. Alvarez measured the difference in blur between frames and calculated the rate of change in blur, thus providing a sensitive record of any unusually erratic movement by Zapruder. All three sets of measurements were plotted on a single graph and used in the subsequent analysis. (See fig. II-5.)



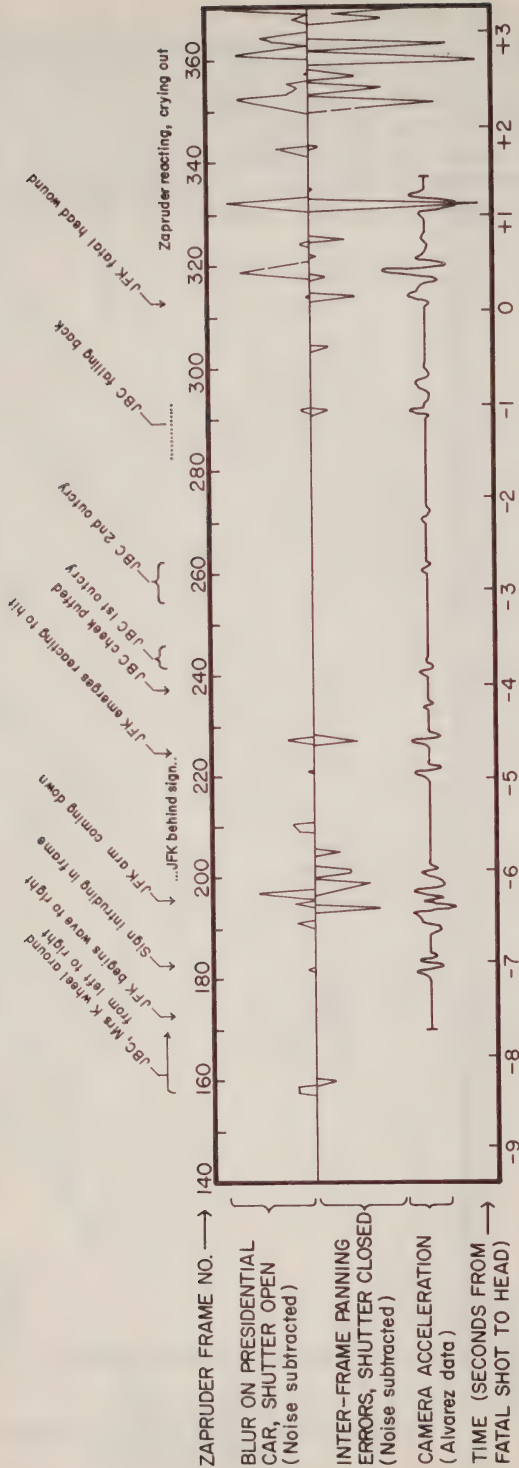


FIGURE II-5.—A comparison of the three independent records of largest blurs or tracking errors in the Zapruder film, as derived by W. K. Hartmann (top, above line), Frank Scott (top, below line), and L. Alvarez (bottom). Magnitude of blur or panning error is indicated by length of curve upward or downward along direction of vertical axis. Frame numbers and times in seconds are given at top and bottom along horizontal axis.

(88) To assist in the analysis, a time-scale in seconds was added to figures II-1, 4 and 5. The zero point in the time-scale was chosen to coincide with the moment when the trigger was pulled on the fatal head shot. This was estimated to have been at frame 310, based on estimates of the average running speed of Zapruder's camera in conjunction with other scientific evidence.

(89) Specifically, Zapruder reported that his camera was fully wound when he started filming the motorcade as it turned onto Elm Street. In 1964, the FBI tested the camera and found that during the first 30 seconds of its operation (after being fully wound) Zapruder's camera ran at between 18.0 and 18.5 frames per second, with the average estimated to be 18.3. Note that the range 18.0 to 18.5, indicates a range of 3 percent uncertainty in all time intervals measured from the Zapruder film. (25)

(90) Fragmentary material from the President's head is seen flying upward and outward in frames 313 and 314. The fragments are already airborne and in motion in frame 313. Extrapolation backwards indicates that the explosion began in frame 312 rather than 313, since this would be the frame nearest to the moment when the fragments left the head. Other scientific evidence, such as wound measurements, and trajectory analysis, indicated that the fatal head shot was fired from a Mannlicher-Carcano rifle located in the southeast corner window of the sixth floor of the Texas School Book Depository. (26) The distance from that window to the limousine at frame 312 is approximately 265 feet. (27) Since a Mannlicher-Carcano bullet travels at approximately 2000 feet per second, (28) the bullet flight time would have been 0.13 second, or the passage of approximately 2.4 frames in Zapruder's camera. Subtracting these two frames from frame 312, it is apparent that the fatal shot was fired at approximately frame 310. (91) Using frame 310 as the time of the trigger pull, it is possible to determine that the sound from that shot would have reached Zapruder at frame 313-314: Zapruder was standing approximately 270 feet from the Texas School Book Depository window, sound travels slightly more than 1,100 feet per second. (29) and the sound of the shock wave from the bullet itself reached Zapruder slightly before the sound of the muzzle blast from the window.

Finally, the pattern of jiggles that was discovered was compared with the results of the committee's acoustics study. The correlation between the jiggle analysis and the acoustics test is treated separately in an addendum to this report.

### *(c) Conclusions*

(92) 1. Two pronounced series of jiggles or blurs on the Zapruder film, one during frames 189-197, a time when other visual evidence suggests that President Kennedy was first shot, (30) and another during frames 312-334, following impact of the head shot, may reasonably be attributed to the photographer's startle reaction to the sound of gunshots.

(93) 2. The timing of the shots associated with these two sets of blurs can reasonably be determined to be approximately 6 to 7 seconds apart.

(94) 3. Other blurs which might relate to gunshots, appear on the

film both between these two sets and elsewhere. Due to the absence of other visual evidence associated with these blurs, the Panel made no finding as to their cause.

(d) *Analysis*

(95) As noted above, the sound from the fatal head shot would have reached Zapruder at frame 313-314. Frame 313 is also the moment when the head explosion became visible to Zapruder. The largest blurs or jiggles on the three independent data sets of Hartmann, Scott, and Alvarez occur between frames 312 and 334. Because some of the jiggles are minor and appear on one or two of the data sets but not all three, it is difficult to determine exactly when the reaction in question actually started. The Hartmann data set shows a very large blur in frame 318 with smaller ones at 313 and 314. (See fig. II-1.) The Scott measurements show several smaller jiggles between 313 and about 324. (See fig. II-4). The Alvarez data show the largest acceleration of camera motion at 315, but with a cluster of motions from 312 to 322. (See fig. II-5.) Empirically, it appears, therefore, that Zapruder's startle reaction apparently occurred about 1 to 5 frames, or about 0.05 to 0.3 seconds after the sound reached him.

(96) In fact, the Panel found some empirical corroboration for this conclusion. Startle reaction times in response to the sound of gunshots were measured in the experimental work of Landis and Hunt in 1939. (31) For "head movement," "movement of neck muscles," and "initiation of arm movement," Landis and Hunt found that the reaction time was 0.06 to 0.2 second (i.e., 1.1 to 3.7 frames). (32) Thus, these much earlier experimental findings support the conclusion that the film actually records Zapruder's startle reaction to the fatal shot immediately after Zapruder heard the sound of the shot and saw the head impact through his viewfinder.

(97) In all three data sets, the second longest and second greatest (in terms of magnitude of blur or jiggle) disturbance in camera panning motion occurs between frames 189 and 197. Since our objective is to estimate the time the shots were fired, the blurred frames of most interest are those from the jiggle's beginning to its peak rather than to its decline. For the various data sets, the time from the first strong increase in blur to the maximum blur or jiggle is as follows: Hartmann, 191-197; Scott, 193-194; and Alvarez, 189-195. (See figs. II-1, II-4, and II-5.)

(98) Assuming that a shot from the sixth floor Texas School Book Depository window caused this reaction (a distance at this point in time of approximately 165 feet from the limousine) (33), and that Zapruder's reaction was again almost immediate (within 1 to 4 frames after hearing the shot), it is possible to calculate backward (adding sound travel time to Zapruder of 4 frames, to reaction time of 1 to 4 frames), and determine that the shot may have been fired between frames 181 and 192, and impacted in the limousine between frames 182 and 193. This conclusion is reinforced somewhat by the Photographic Evidence Panel's visual observation of the Zapruder film which reflected a reaction by President Kennedy to some severe external stimulus by frame 207 when the President disappears behind a sign frame. (34) Assuming a uniform reaction time in both cases by Zapruder, and that both shots originated in the same location (the



sixth floor window), the trigger pull on this shot would have preceded that of the fatal head shot by approximately 6.3 to 6.9 seconds (minimum, 313-197 over 18.5 equals 6.3; maximum 313-189 over 18.0 equals 6.9).\*

(99) The blur or jiggle results have been examined for other blur episodes that possibly correlate with additional gunshots. The three next largest episodes of blur are listed in table 1, in which the largest and second largest blur episodes discussed above are designated A and B. The third, fourth, and fifth largest blur episodes, which are similar to one another in magnitude, are listed respectively as C, D, and E.

(100) It is difficult to determine with certainty whether any of these represents an additional shot or shots. Blur episode C, detected by all three analysts, occurs at frames 220-228, just before movements of Governor Connally in which his cheeks suddenly puff out and his face contorts in a grimace, followed by two apparent outcries in which his mouth opens wide in what appears to be a shout of pain.

(101) Another shot could have caused blur episode D at frames 158-160. It occurs much earlier in the motorcade than had been considered possible for a shot by either the Warren Commission or most Warren Commission critics. Nonetheless, this brief blur was detected by both Hartmann and Scott; Alvarez published no data for such an early part of the motorcade because he used the Warren Commission volumes which do not even reproduce Zapruder frames earlier than the mid-170's. The most interesting thing about this hypothetical shot is that Mrs. Kennedy and Governor Connally testified before the Warren Commission and Governor Connally testified before the select committee that they turned to their right when they heard the first shot, (35) and both are seen in the film beginning a turn to the right immediately after this hypothetical shot. This appears particularly striking in the case of Governor Connally, whose head turns from midleft to far right in less than half a second, beginning at frame 162.

(102) A fifth episode (E) possibly associated with a shot occurs at frames 290-293. Although it contains a very small blur detected by both Hartmann and Scott, as well as a more substantial blur in Alvarez' data, the Panel found no visual indications of reactions to a shot by the limousine's occupants coinciding with this segment of blur in the film.

(103) Other jiggles or blurs were present in the photographic record. (See fig. II-5.) Without further data, however, the magnitude and duration of these jiggles, as those with characteristics of C, D, and E, are insufficient to warrant any conclusion concerning the number and timing of any additional gunshots.

\*Assuming a uniform reaction time, and a uniform distance of Zapruder from the shooter, it is possible to ignore delays caused by sound travel from the shooter to Zapruder and Zapruder's reaction time in calculating the spacing of the two shots, since any assumed value for such delays would be self-canceling in the calculation.

TABLE 1.—BLURS IN ZAPRUDER FILM

Relative magnitude of blur episode	Designation of blur episode	Shown by	Frames showing blur onset (beginning to maximum)
Largest.....	A <sub>1</sub>	Alvarez..... Hartmann..... Scott.....	312-318 313-318 313-314
	A <sub>2</sub>	Alvarez..... Hartmann..... Scott.....	330-334 331-332 331-333
2d largest.....	B	Alvarez..... Hartmann..... Scott.....	189-195 191-197 193-194
3d largest <sup>1</sup> .....	C	Alvarez..... Hartmann..... Scott.....	220-228 227 226-228
4th largest <sup>1</sup> .....	D	Hartmann..... Scott.....	158-159 158-160
5th largest <sup>1</sup> .....	E	Alvarez..... Hartmann..... Scott.....	291-293 290-291 290-292

<sup>1</sup> About equal.

## ADDENDUM

## COMPARISON WITH RESULTS OF THE ACOUSTICS ANALYSIS

(104) The acoustics analysis suggests the possibility of four shots, the first, second, and fourth originating from the Texas School Book Depository and the third having been fired from the grassy knoll. (36) This appendix discusses the extent of agreement between the acoustic timings and the major blurs on the Zapruder film.

(105) A first step in comparing the acoustic results to the blur analysis would be to line up one of the shots indicated by the acoustics analysis with the known fatal head wound to the President. This cannot be shots No. 1 or No. 2 from the acoustics analysis because the President's reaction to the back wound, at approximately frame 200 would then occur before any shooting. Therefore, the fatal head wound had to be shot No. 3 or No. 4. It is improbable that the fatal head shot was shot No. 3 because the acoustics analysis places this shot as coming from the grassy knoll, while the medical and other scientific evidence indicates that the President's head was struck from the rear. (37) The fatal head shot, therefore, was probably the last shot identified in the acoustics analysis.

It is thus a simple step to work backward in time from that final shot to derive the times that Zapruder heard shots based on the acoustics results. The acoustics report states that the time intervals between the four shots recorded on the Dallas Police Department tape are 1.57, 5.63, and 0.71 seconds respectively, (38) but that the Dallas Police Department recorder was running approximately 5 percent too slow. (39) Adjusting for this 5-percent error, the actual spacing of the shots to the nearest one-tenth second would therefore be 1.6, 6.0, and 0.7 seconds.

(106) As noted earlier, the FBI tested Zapruder's camera in 1963. They found that its speed varied from 18.0 to 18.5 frames per second during the first 30 seconds of its operation (after being fully wound), and then ultimately decreased to 17.6 frames per second before it completed the next 30 seconds of its operation. Because Zapruder said his

camera was fully wound when he began filming the motorcade, it may be assumed that the camera ran between 18 and 18.5 frames per second during the approximately 8 seconds of the assassination. Using these parameters for film speed, and allowing for sound and bullet travel times, the frames exposed when the bullets would have reached the limousine, and when Zapruder would have heard the muzzle blast, can be calculated. (See cols. 3 and 4 of top of table II.)

(107) In constructing and then using table II, a note of caution is appropriate: Any calculation of the frames exposed, based upon a correlation with the sound impulses on the Dallas Police Department tape, should not be presumed to be absolutely precise because only the average, and not the precise, running speeds for the camera are known, and the tape speed adjustment of 5 percent is similarly only an average. Thus, table II reflects mathematical calculations of frame numbers utilizing the available averages, that is, a tape speed adjustment of 5 percent (although the tape may have actually been closer to  $4\frac{1}{2}$  percent or  $5\frac{1}{2}$  percent slow at times) and the parameters of 18.0 to 18.5 frames per second camera speed. The actual frames when an event occurred may have been a frame or two different than the calculations based upon such estimated averages.

(108) As can be seen from columns 3 and 6 of the table, there is good correlation for shots 1, 2, and 4, where in each case the blurs occur when the acoustics data reflect Zapruder would have heard the shots. On the other hand, there is no correlation (except possibly for the Scott measurements) for shot No. 3, since the blur at 289-293 precedes the arrival of sound at Zapruders' location and thus could not have been a product of his startle reaction to that sound.\*

(109) The same calculations and comparisons can be made using the assumption that the third shot (the one from the grassy knoll) caused the head wound at frame 312. This process is reflected in the lower portion of table II. Here there are blurs following each shot, the first two lagging behind Zapruder's hearing of the sound by 9 to 12 frames ( $\frac{1}{2}$  to  $\frac{2}{3}$  second), and the second two immediately following his hearing the sound.

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\*There is one relatively small panning error between frames 300 and 305 detected by Scott's technique. See figure II-4.



TABLE II

IF THE FOURTH SHOT CAUSED THE FATAL HEAD WOUND					
ACOUSTICS STUDY				PANNING ERROR - BLUR ANALYSIS	
Unadjusted Tape Time	Adjusted Spacing *	Frames Exposed When Zapruder Heard Shots	Frames Exposed At Bullet Impact	Blur Episode**	Blurred Frames
137.70		159-165	157-161	(D)	158-160
139.27	1.6	191-194	188-191	(B)	189-197
144.90	6.0	296	295-296	(E)	290-293
145.61	.7	313-314	312	(A <sub>1</sub> )	312-318
IF THE THIRD SHOT CAUSED THE FATAL HEAD WOUND					
137.70		175-181	173-177	(B)	189-197
139.27	1.6	208-210	205-208	(C)	220-228
144.90	6.0	312	312	(A <sub>1</sub> )	312-318
145.61	.7	330	328-329	(A <sub>2</sub> )	330-334

\* These times are the adjusted spacing of the sound impulses on the Dallas Police Department tape recording, and not the spacing of trigger pull or bullet impact times, which would vary somewhat from these times based upon the distances between the weapons, the limousine, and the motorcycle microphone that transmitted the sounds.

\*\* The blur episodes are taken from Table I.

#### 4. THE TRAJECTORY ANALYSIS\*

##### (a) Introduction

(110) A trajectory is the path taken through space by an object such as a missile or bullet. In general, the trajectories of missiles are curved because of factors such as gravity and aerodynamic forces. Nevertheless, in the case of high speed bullets traveling short distances, the curvature is typically slight. (40) In such cases, the effect of aerodynamic forces is small both because the projectile flies almost perfectly nose-on through the air and because any small side-to-side movements tend to cancel one another by virtue of the bullet's spin. (41) The effect of gravity is similarly slight and can be easily calculated. For a total flight path of 200 feet at 2000 feet per second (the speed of a bullet from a moderate performance rifle), the time in flight is one-tenth of a second. During this period, gravity deflects the flight path only two inches. (42) A high performance rifle bullet would be deflected even less because it is traveling faster and its time in flight is shorter. It is, therefore, permissible to characterize the trajectory of each bullet fired at the President as a straight line extending between rifle and victim.

##### (b) Issues

(111) In connection with the trajectory analysis, the Panel undertook to answer three questions:

\* This section was prepared under the direction of Thomas N. Canning, with the assistance of Clyde C. Snow and C. S. McCamy. For the related public hearing testimony of Canning and McCamy, see HSCA-JFK Hearings, 9/12/79, vol. II, pp. 142-203.

- (112) 1. What were the trajectories of the bullets that struck the President?
- (113) 2. Is the trajectory of the bullet that caused the President's back and neck wounds consistent with the single bullet theory?
- (114) 3. Given the trajectories, from where were the bullets fired?

*(c) Procedures*

(115) A straight line trajectory can be constructed once any two points the missile is known to have passed have been established. In the present study, the inshoot and outshoot wounds inflicted by the bullets that struck President Kennedy and Governor Connally were used as the two points.

(116) In order to calculate the trajectory based on these wound pairs, it was necessary to establish the position of each entry and exit point in space at the time it was inflicted. This requires that three determinations be made:

(117) 1. The location of the wounds relative to recognizable reference features of the victim had to be established. Ideally, this information could be expressed in terms of a measured distance left or right from the midplane of the body along well-defined directions in reference to clear external features such as an ear or elbow.

(118) 2. It was necessary to determine the angular orientation of the wounded part of the victim relative to his immediate surroundings—that is to say, in what direction he was facing, what his inclination was forward or backward, and to which side he was leaning and by how much.

(119) 3. It was necessary to know where the victim was located relative to his surroundings, i.e., the location of the victim within the limousine and the location of the limousine relative to known landmarks in Dealey Plaza.

(120) The requisite information for undertaking this particular trajectory analysis could not be accurately obtained from any single source. Consequently the committee asked its various scientific consultants to provide input from their areas of expertise. The Forensic Pathology Panel was responsible for providing, to the extent possible, the precise locations of the wounds sustained by Kennedy and Connally.\* It relied on enhanced postmortem photographs and X-rays of President Kennedy which were produced by the Photographic Evidence Panel. Enhanced photography was further used in the effort to determine the precise orientation of President Kennedy at the time of the assassination. The Photographic Evidence Panel also assisted in the interpretation of motorcade photographs of Kennedy and Connally and in providing photogrammetrically derived measurements of critical aspects of the photographs. Finally, the actual placement of the presidential limousine in the Dealey Plaza area at the time of the

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\*While the Forensic Pathology Panel did provide this information, the actual measurements related to wound locations were determined by the NASA scientist who was responsible for supervising the trajectory project. He was in frequent consultation with members of the Forensic Pathology Panel and with forensic anthropologists from both the FAA's Civil Aeromedical Institute and the Smithsonian Institute.

shots was established through a photogrammetric analysis conducted by the U.S. Geological Survey (USGS).<sup>1</sup> (43)

(121) All the preceding information was compiled under the supervision of Thomas N. Canning, an engineer from the Space Project Division of NASA, who then was responsible for constructing the actual trajectories. In contrast to the trajectory analysis performed by the Warren Commission, (44) the investigative procedures and analyses in this instance were governed by the hypothesis that there was no other evidence (e.g., the discovery of bullet cartridges and a rifle in the Texas School Book Depository) concerning the source of the shots.

(122) Although all of the available scientific evidence indicated that President Kennedy and Governor Connally were struck by a total of two bullets, one hitting President Kennedy in the back and continuing through to enter Governor Connally after exiting President Kennedy's neck, and the other hitting President Kennedy's head, three different trajectories were constructed: One based on the entry and exit wounds to President Kennedy's head, another on President Kennedy's back-neck wounds, the last on the exit wound to President Kennedy's neck and the entry wound to Governor Connally's back.<sup>2</sup> The first two trajectories were constructed for the purpose of determining whether the two shots were fired from the same location and the third to determine whether the relative alinement of President Kennedy and Governor Connally in the limousine was consistent with the single bullet theory.

#### (d) *Conclusions* <sup>3</sup>

(123) *Kennedy's head wounds.*—The bullet that caused Kennedy's head wounds at Zapruder frame 312 came from a point 29° to the right of true north from the President. The bullet was descending at an angle of 16° below horizontal as it approached him. This trajectory intercepted the plane of the Texas School Book Depository approximately 11 feet west of the southeast corner of the building at a point 15 feet above the sixth floor windowsills.

(124) *Kennedy's back and neck wounds.*—The bullet that caused President Kennedy's back and neck wounds came from a point 26° to the right of true north from the President. It was descending at an angle of 21° below horizontal as it approached him. Extending this trajectory from the position President Kennedy occupied at the time of Zapruder frame 190, the trajectory intercepted the plane of the Texas School Book Depository approximately 11 feet west of the southeast corner and 2 feet lower than the sixth floor windowsill.

(125) *Kennedy neck and Connally back wounds.*—The bullet which caused President Kennedy's neck wound and Governor Connally's back wound came from a point 27° to the right of true north from the Presi-

<sup>1</sup> USGS was asked to determine the position of the limousine at times corresponding to Zapruder frames 150, 190, 285, 313, and 413; however, because some of these frames did not provide the required visual coordinates, the nearest frame with sufficient reference points was used.

<sup>2</sup> No trajectory analysis based solely on the wounds suffered by Connally was attempted because the bullet that struck him in the back hit at least two bones (at oblique angles) and was consequently significantly deflected.

<sup>3</sup> Explanatory diagrams supporting these conclusions are set forth in the analysis section of this report.



dent and was descending at an angle of  $25^\circ$  below horizontal.

(126) Given the position of the two men at the time of Zapruder frame 190, the trajectory intercepted the plane of the Texas School Book Depository 2 feet west of the southeast corner and 9 feet above the sixth floor windowsill. Because this trajectory falls within the trajectory range established when President Kennedy's back-neck wounds are used as the reference points for the trajectory line, the Panel concludes that the relative alinement of President Kennedy and Governor Connally within the limousine is consistent with the single bullet theory. Further, since each of these trajectories intersects the plane of the Texas School Book Depository in the vicinity of the southeast corner of the sixth and seventh floors, it is highly probable that the bullets were fired from a location within this section of the building.\*

### (e) *Analysis*

#### (1) *The head wound case\**

(127) To determine this trajectory, the Panel first had to locate the entrance and exit head wounds as precisely as possible. Figures II-6 and II-7 show where the fatal bullet entered the back of President Kennedy's head at a point 9.0 centimeters above the external occipital protuberance. (45) This distance was measured on postmortem X-rays from point to point. The entry point is 1.8 centimeters to the right of the midplane of his skull. The bullet passed forward through his head and exited at the right coronal suture at a point 11 centimeters forward of the entry wound and 5.5 centimeters to the right of the midplane. This exit point was 1 centimeter lower than the entrance wound, using as the exterior vertical reference a line drawn through the President's brow and upper lip. Thus the bullet was traveling  $18.6^\circ$  to the right relative to his midplane and  $5.0^\circ$  downward relative to his facial axis.

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\*The above conclusions differ to some extent from the testimony given by Thomas N. Canning before the House Select Committee on Assassinations on Sept. 12, 1978, in each case, the differences reflect new information or analysis resulting from work concluded subsequent to the presentation of preliminary findings at the heading.

\*The interpretation of the head wounds used in defining trajectory reported in testimony on Sept. 12, 1978 differs from this report because the final illustration from the Forensic Pathology Panel showed the exit wound to be 1 centimeter lower than the entrance, rather than level with it as had been concluded earlier. Thus, the resulting trajectory is somewhat steeper.

# LOCATION OF HEAD WOUNDS IN PRESIDENT KENNEDY

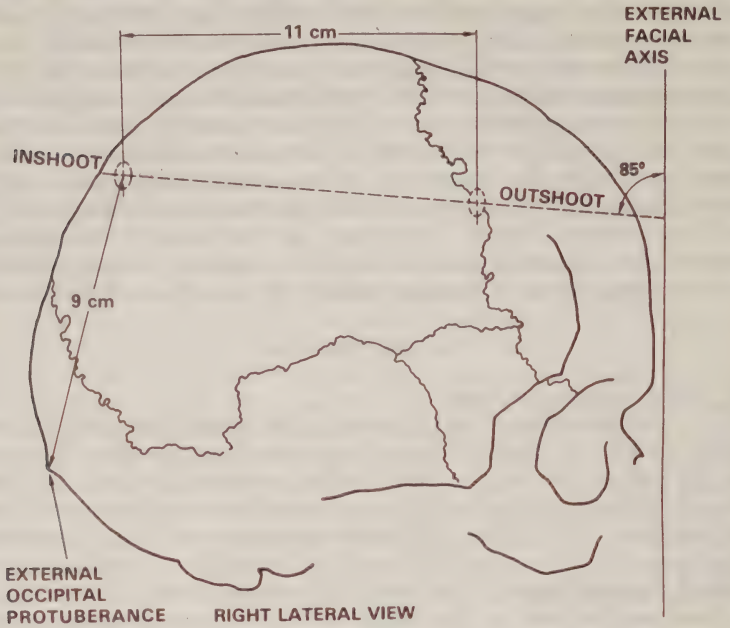


FIGURE II-6

# LOCATION OF HEAD WOUNDS IN PRESIDENT KENNEDY

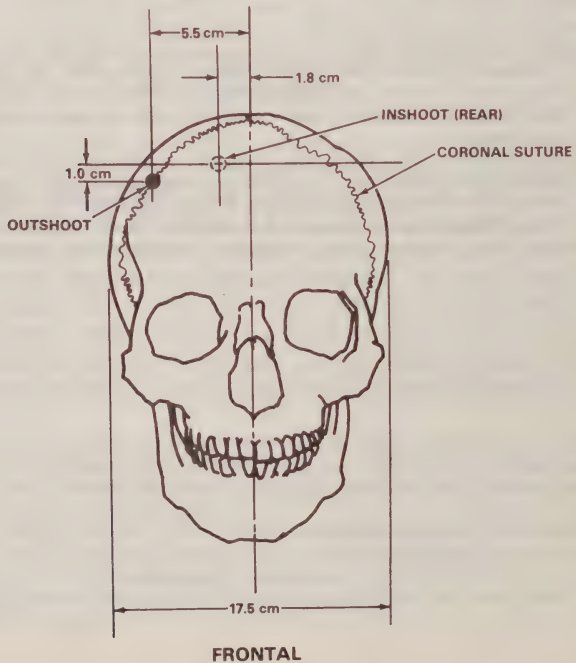


FIGURE II-7

(128) Once these wound locations were established, derivation of the bullet's trajectory still required knowledge of the orientation of Kennedy's head relative to Dealey Plaza. Establishing this relationship from the photographs was most easily accomplished in two steps: (1) finding the position of Kennedy's head relative to the line of sight to Zapruder's camera, and (2) accounting for the orientation of that line relative to the entire Dealey Plaza area.

(129) The Zapruder and Nix films showed the position both of Kennedy's head and of suitable reference structures in the field of view such as walls, street lights, and curbs. Since Kennedy's head is seen exploding in frame 313 of the Zapruder film, frame 312, which was exposed 0.055 seconds earlier, was considered to be the most important photograph available for this aspect of the trajectory analysis. (See JFK exhibit F-254.)

(130) The key features to be analyzed in frame 312 with respect to determining the orientation of Kennedy's head, were the lateral and vertical position of his right ear relative to the outline of the head and the overall relationship between his ear, nose and eyebrow. Rather than basing the analysis on a purely subjective interpretation, orientation was determined by comparing these features, as they appeared in an enhanced print of Zapruder frame 312 (see fig. II-8, JFK exhibit F-134), with a series of calibration photographs of a replica of Kennedy's head prepared by the Civil Aeromedical Institute of the



FIGURE II-8



FAA's Aeronautical Center.\* These calibration photographs were taken from many carefully measured aspects (lines of sight), including several which closely approximated the relative location of Zapruder's camera at frame 312. (See fig. II-9, JFK exhibit F-141.)



FIGURE II-9.—Calibration photograph corresponding with Zapruder frame 312.

(131) After studying those photographs most closely approximating the correct aspect, it was possible to determine, by comparing the positions of such features as Kennedy's ear relative to other parts of his head, the aspect from which Zapruder's camera viewed Kennedy. On this basis, it was determined that Kennedy was turned partially away from Zapruder—approximately  $25^\circ$  past the  $90^\circ$ , or profile, direction. His head was tilted away from Zapruder by about  $15^\circ$ , and he appeared to be nodding forward by about  $11^\circ$  (clockwise, as viewed by Zapruder).

(132) In order to obtain a similar set of relationships relative to landmarks in Dealey Plaza, it was necessary to establish the orientation and position of this line of sight. Its direction and the point where it intercepts Kennedy's head were determined by drawing a line on a scaled map of Dealey Plaza between Zapruder, whose position had been derived from other photographs and testimony, and Kennedy at the geographic position on the street corresponding to the limousine's location at the time that Zapruder frame 312 was exposed. The latter was determined by relying on the photogrammetric

\* The construction of the replica and the taking of the calibration photographs are described in addendum A, at pars. 169-176 *infra*.

analysis of the USGS. (46)\* (See fig. II-10, JFK exhibit F-133.) The slope of this line was calculated by considering the relative heights of both the pedestal on which Zapruder was standing and of the street at the point where the limousine was located at frame 312, and then measuring the distance between Zapruder and Kennedy.

(133) The pedestal on which Zapruder stood was 12 feet above the point on Elm Street occupied by Kennedy at the time of Zapruder frame 312. When both the height at which the camera was held and the height of Kennedy's head above the street were considered (about 5 feet and 4 feet, respectively), the camera was determined to have been about 13 feet higher than Kennedy. The distance between Kennedy and Zapruder was about 70 feet at the time of the fatal shot. (See fig. II-10, JFK exhibit F-133.) Given this height difference and the distance between the two men, a line of sight downward from Zapruder to Kennedy was computed to be at an angle of  $10^{\circ}$ .

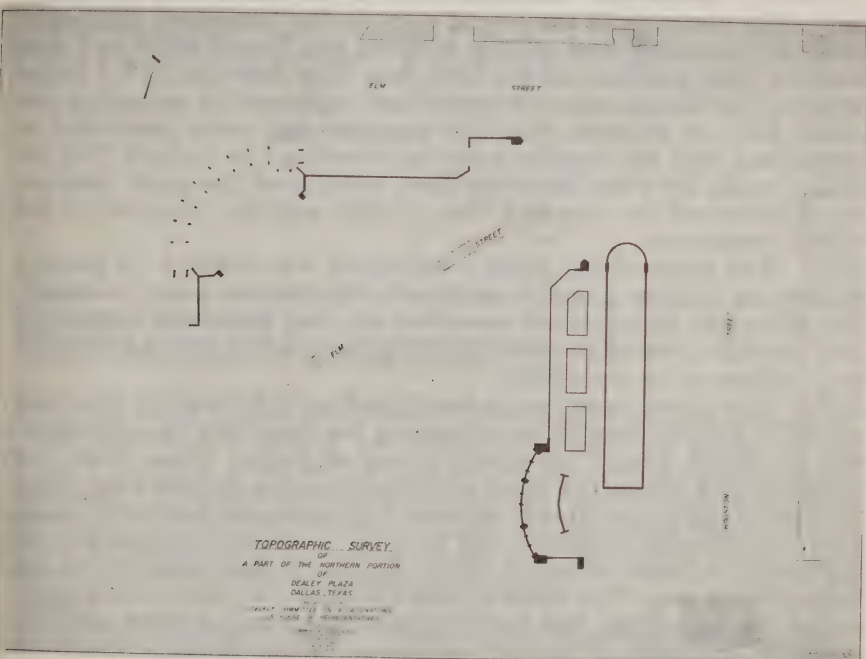


FIGURE II-10

(134) Once these factors had been established, the geometric relationship between the line of sight from Zapruder's camera and the trajectory line defined by the inshoot and outshoot wounds in Kennedy's head was determined.

(135) A physical reconstruction, consisting of a wooden mockup based on the photographic analysis of Zapruder frame 312, was used.

\*Because Zapruder frame 313 provided better reference points, the USGS used that frame to determine the location of the limousine. Based on the limousine's estimated average speed, an adjustment of 1 foot was made to locate the vehicle at frame 312.

In the mockup, the camera line of sight was represented by a straight dowel. The midplane of Kennedy's head was represented by a flat piece of wood to which the line-of-sight dowel was affixed in a manner reflecting its relative slope and direction. A second straight dowel was installed vertically at the front of the midplane to represent the external facial axis defined by the forehead and upper lip. Finally, to simulate the location of the entry and exit wounds, two short posts were fastened to the midplane 11 centimeters apart and extending 1.8 and 5.5 centimeters outward on the same side as the line-of-sight rod. These posts were fitted with circular tips—one open and the other solid—to serve as sighting points. The positions of the posts relative to the facial axis and line-of-sight rods duplicated the positions of the wounds as located by the Forensic Pathology Panel.

(136) This assembly was then supported on a photographer's tripod in a laboratory so as to duplicate the slope of the line of sight of Zapruder's camera and the inclination of the facial axis simultaneously. The direction of the line of sight in the laboratory was registered by mounting two plumb bobs on the line-of-sight rod and marking their positions on the level floor. The direction of the bullet trajectory in the laboratory was similarly registered by mounting two plumb bobs on separate, movable supports that were positioned to correspond with the circular posts representing the wounds. The resulting angle between these two lines established the angle between the direction of the camera's line of sight and the direction of the bullet's trajectory.

(137) The slope of the bullet's trajectory was deduced by placing markers on the two plumb bobs alined with the two posts (wounds). The difference in height of these two markers above the laboratory floor and the distance between the two plumb bobs were used to calculate the slope of the trajectory.

(138) The direction and slope determined in the laboratory were then related to the real case by incorporating the same data on scale drawings developed from a topographic map of Dealey Plaza. First, the limousine and Kennedy's head were positioned in the drawing. Then the line of sight was drawn between Zapruder and Kennedy's head. Next, the direction angle derived from the laboratory replication was duplicated in order to arrive at the trajectory direction line on the Dealey Plaza map. This line was then extended rearward until it intercepted the face of the first building it encountered—a point approximately 11 feet west of the southeast corner of the Texas School Book Depository. (See fig. II-11.)



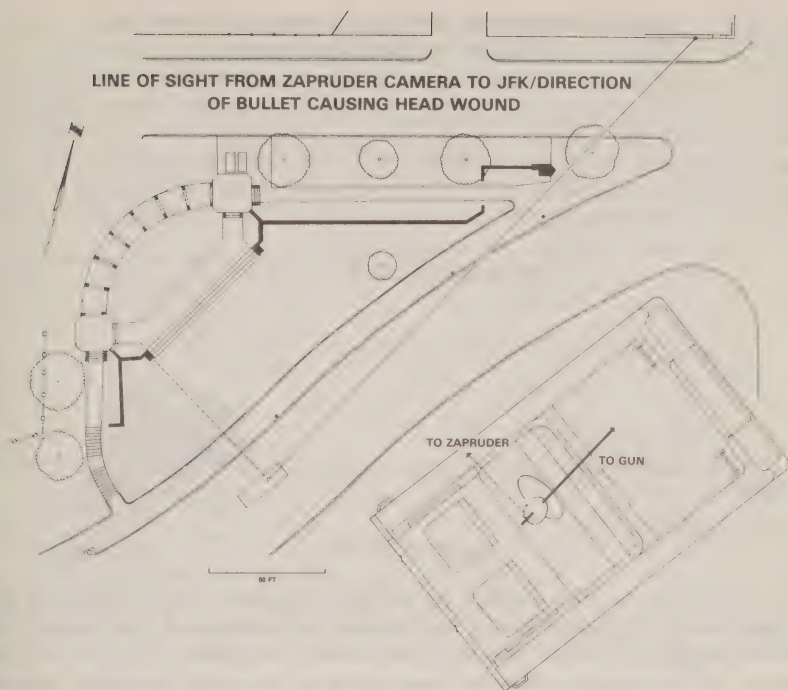
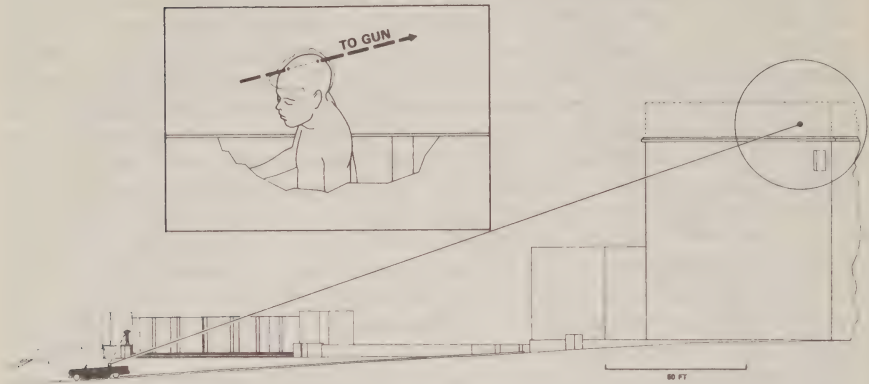


FIGURE II-11.—This diagram depicts the line of sight from Zapruder's camera to President Kennedy and the trajectory direction of the bullet that caused the fatal head wound. Note that the limousine shown at the right is an enlargement of the one drawn in the middle of the diagram.

(139) In order to show the slope of the trajectory without distortion, it was necessary to develop an oblique elevation view shown in fig. II-12. This view is an orthogonal projection onto a vertical plane parallel to the bullet's trajectory. In this view, the resulting trajectory slope of  $16^\circ$  is shown to intersect the Texas School Book Depository at a point approximately 11 feet west of the southeast corner of the building and 15 feet above the sixth floor windowsills.\*

\* The revision in relative heights of the inshoot and outshoot wounds in Kennedy's head resulted in most of the difference in this trajectory from that presented in testimony before the House Select Committee on Assassinations on September 12, 1978. The remaining revisions resulted from the availability of a superior enhanced reproduction of Zapruder frame 312 for comparison with the calibration photographs.

**LINE OF SIGHT FROM ZAPRUDER CAMERA TO JFK/SLOPE  
OF BULLET CAUSING HEAD WOUND**



**FIGURE II-12**

(140) A circle with a radius of 23 feet has been drawn around the intersect point in figure II-12 represents the estimated minimum reasonable margin of error for this trajectory analysis.\* To derive this estimate of the margin of error, each step in the analysis was checked for possible errors. Factors such as the position of Zapruder and Kennedy and the height of the pedestal on which Zapruder stood were not considered significant sources of error. The major uncertainties related to the wound positions and the orientation of Kennedy's head relative to Zapruder.

(141) For example, of critical importance in comparing calibration photographs with Zapruder frame 312 was the apparent position of Kennedy's right ear in relation to his nose, brow and back of head. An error of  $1.0^\circ$  (equal to about 0.16 centimeter), in positioning the ear on the replica of the head would yield approximately  $1.0^\circ$  error in the deduced trajectory \*\* if not offset by other factors in interpreting the photographs or elsewhere. Similarly, establishing the relationship of those elements critical in determining the degree to which Kennedy's head was nodding forward (for example, the line from his brow to his upper lip relative to the slope of the street) also required careful and repetitious measurements to minimize errors. All measurements were made repeatedly, using as many independent image cues as could be found. The redundancy of the cues selected and the repetition of the studies, coupled with the probable random direction of any errors introduced, allows the Panel to conclude that a liberal estimate for the margin of error is about  $5^\circ$  (that is, a 23-foot radius around the intersect point at the Texas School Book Depository).

*(2) The back-neck case*

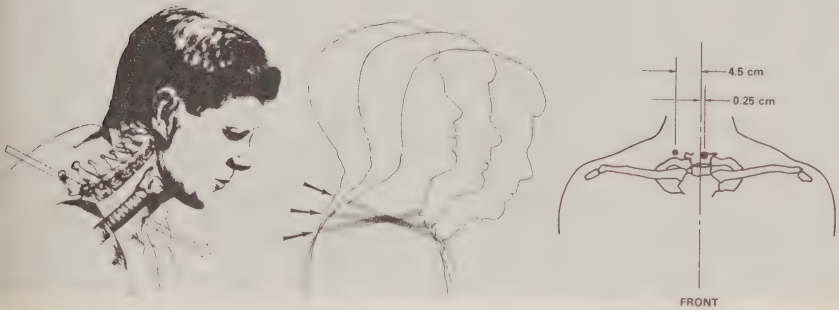
(142) According to the autopsy photographs, the first bullet to strike Kennedy entered his back slightly about his shoulder blade and slightly to the right of his backbone. (See fig. II-13.) This bullet passed

\*That is to say that the margin of error could be greater.

\*\*A 1-degree error results in a movement of about 4 feet at a range of 250 feet.

through soft tissue hitting no bone, and exited at the front of his neck. (47) Independent determinations by the Photographic Evidence Panel showed the entrance wound to be from 4 to 5 centimeters from Kennedy's center plane and the exit wound to be on the center plane or as much as 0.5 centimeters to its left. When seen in the autopsy position, the outshoot wound was described as being at about the same height (or slightly higher) relative to the inshoot wound. The distance between the wounds was determined to be 14 centimeters.

### J.F.K. WOUND LOCATIONS



NOTE: DISTANCE BETWEEN INSHOOT & OUTSHOOT WOUNDS = 14cm

FIGURE II-13

(143) Based on the acoustics results (48), the camera blur study (49) and the visual observations made by the Photographic Evidence Panel, (50) it was determined that Kennedy was struck by this bullet at a time corresponding approximately to Zapruder frame 190. Accordingly, to determine Kennedy's orientation at that point, frame 190 and adjoining frames were closely scrutinized. (51) (See JFK exhibits JFK F-225-227.)

(144) The best record of Kennedy's posture, torso inclination, and shoulder "hunching" is a photograph taken by Robert Croft at about the time of Zapruder frame 161. (52) (See fig. II-14, JFK exhibit 135.) This correlation was established by the Photographic Evidence Panel by examining features in the Croft photograph and studying Croft's movements as recorded in the Zapruder film.

(145) In Croft's picture, Kennedy and other persons in the limousine are seen from a perspective that permits a reasonable determination of their posture and orientation. Kennedy's upper torso/neck region was inferred from this photograph to have been inclined forward at an approximate angle of  $11^{\circ}$  to  $18^{\circ}$  relative to a line drawn upward from and perpendicular to the road surface. The range of this angle is well within a much larger range derived from studies of many other photographs taken during the motorcade. Although the Croft photograph corresponds to Zapruder frame 161, there is no indication in the Zapruder movie that Kennedy changed his inclination substantially before he was hit in the back. (53) (See JFK exhibits F-226-242.)





FIGURE II-14

(146) The Croft photograph also shows Kennedy's torso facing nearly straight forward. At Zapruder frame 190, however, he is seen to turn his head about  $60^\circ$  to his right (see JFK exhibit F-226), and it is reasonable to expect that he also would have rotated his shoulders a small amount in the same direction. Most probably, this rotation was only  $5^\circ$  or less, as judged by the absence of obvious large shifts in body position in the Zapruder movie. Thus, it was assumed that, except for turning his head by about  $60^\circ$  and his torso perhaps by  $5^\circ$ , Kennedy made no major changes in posture after frame 161. This assumption is supported by a photograph taken by Phillip Willis at about the time of Zapruder frame 202.\* (See fig. II-15, JFK exhibit F-155.)

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\*Establishing when the Willis photograph was exposed in reference to the Zapruder film was done by the Photographic Evidence Panel by studying the Zapruder film and determining when Willis could actually be seen snapping his picture. In the study of the back/neck wounds trajectory, calibration photographs of the anthropometric dummy were taken but not used (that is, for measurement analysis) because, unlike the head, the torso is quite mobile, and consequently there is no stable relationship between the various body parts. It was decided that to rely on the calibration-photograph technique in this instance would have given a false sense of accuracy to the analysis.



FIGURE II-15

(147) The Panel then had to adjust slightly the wound locations that had been provided based on the autopsy photographs and X-rays because of their difference in body position from that at the time of the shooting. During the autopsy, Kennedy was in an anatomical position with his face tilted as if looking upward about  $35^\circ$ , a posture and conformation significantly different from those at the time of the assassination.

(148) Appropriate adjustments were made under the direction of Dr. Clyde Snow, a forensic anthropologist at the Civil Aeromedical Institute of the FAA's Aeronautical Center. It was determined that returning Kennedy's head to a normal position relative to his body would, according to laboratory tests on men of similar build, adjust his neck wound down about 1.0 centimeter toward his breastbone. Returning Kennedy's head to the position it was in at the time he was first wounded—about  $60^\circ$  to the right of straight ahead of his torso—caused only a slight change in the position (approximately 0.1 centimeter to the right of its observed position in the autopsy photographs). (54)

(149) Because the Zapruder film showed that Kennedy had raised his right shoulder slightly so as to place his elbow on the side of the limousine, the resulting movement of skin at the inshoot location was also assessed. It was found that the wound was approximately 0.1 centimeter higher and 0.2 centimeter closer to his midplane than the post mortem photographic observations by themselves indicated. (55) While only the vertical position of the neck wound was substantially altered by these changes in conformation, all the adjustments were included in the analysis of trajectory.

(150) Using the average locations and adjustments, the back wound was located at a point 4.4 centimeters to the right of and 1.1 centi-



meters above Kennedy's neck wound at the time of the shot. The bullet was moving from right to left by  $18^\circ$  and downward by  $4.0^\circ$  relative to Kennedy if he were sitting erect (not inclined forward or aft). Since Kennedy was believed to have been turned about  $5^\circ$  to his right relative to the fore-and-aft line of the limousine, it is concluded that the bullet was moving from right to left by  $13^\circ$  relative to the midline of the limousine. By a similar analysis, since Kennedy was inclined slightly forward by approximately  $11^\circ$  to  $18^\circ$  (from true vertical), the downward slope of the trajectory, taking into account the  $3^\circ$  slope of the street, was established at between  $18^\circ$  and  $25^\circ$  ( $4^\circ$  plus  $11^\circ$  to  $18^\circ$ , plus  $3^\circ$ ). The Panel decided to use an angle of  $21^\circ$  for its analysis. (151) The analysis by the USGS of the limousine's motion through Dealey Plaza provided both the location and angular orientation of the limousine at a time corresponding to Zapruder frame 193; (56) adjustments were then made with reference to Zapruder frame 190. (See fig. II-10, JFK exhibit F-133.)

(152) The direction of the trajectory was then determined by drawing a line on a scaled diagram of Dealey Plaza at a  $13^\circ$  (that is,  $18^\circ$  minus  $5^\circ$ ) angle relative to the car and extending it to the rear until it intercepted the first building that it encountered. Assuming frame 190 as the moment of impact, the trajectory line intercepts the Texas School Book Depository approximately 14 feet west of its southeast corner. (See fig. II-16). Using an angle of  $21^\circ$ , the slope of the trajectory was then drawn onto a similarly scaled diagram and found to intersect the Texas School Book Depository at a point almost level with the sixth floor windowsill. (See fig. II-17.)

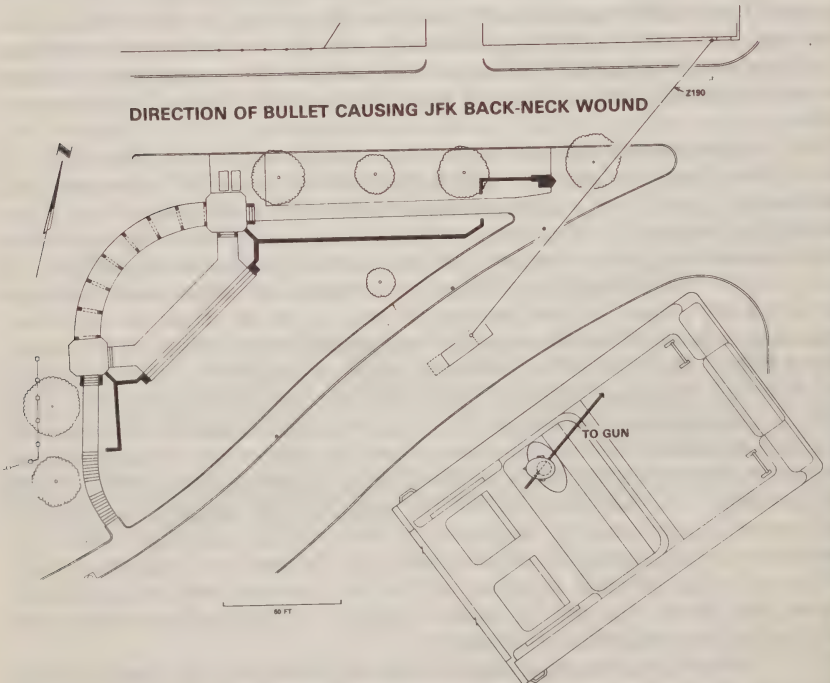


FIGURE II-16



## SLOPE OF BULLET CAUSING JFK BACK-NECK WOUND

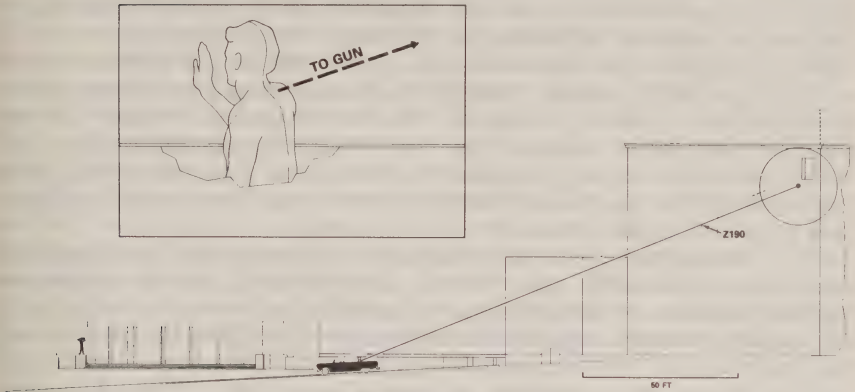


FIGURE II-17

(153) A circle with a radius of 13 feet has been drawn about the intercept point of the trajectory in figure II-16, reflecting the margin of error. It represents the estimated minimum reasonable margin of error that can be ascribed to this analysis.

(154) The same kinds of considerations as were discussed for the head wounds case were applicable in assessing the accuracy of the trajectory based on the President's torso wounds. Here the most critical issue was Kennedy's upper torso attitude rather than the orientation of his head. Consequently, different types of problems were encountered.

(155) The Croft photograph, while quite illustrative of Kennedy's posture, lacked two features noted in Zapruder frame 312. Since the torso is flexible, no clear stable relationship could be established between the photographed exterior and the unseen interior. Further, this picture was taken at least 1.5 seconds before Kennedy was wounded. During this interval, he had turned his head about  $60^\circ$  to his right and may have shifted his torso slightly. Thus, errors of  $5^\circ$  may easily be present in this interpretation. Finally, an accurate determination of his back and neck wound locations was impeded both by the extremely inappropriate lighting and composition of the autopsy photographs and by the distortions resulting from the tracheostomy performed at Parkland Memorial Hospital. These latter problems probably contributed little to the uncertainty in trajectory location as compared with the more serious difficulties arising from the poor photographic definition of his posture and position.\*

### (3) *The single-bullet theory trajectory*

(156) In order to examine the hypothesis that the bullet responsible for Kennedy's back and neck wounds was also responsible for Connally's wounds, a trajectory was constructed based on Kennedy's exit

\*The  $5^\circ$  margin of error resulted in a smaller margin-of-error radius than in the head wound trajectory because in this case the limousine was substantially closer to the Texas School Book Depository. (See fig. II-10, JFK exhibit F-133.)

neck wound and the entrance wound in Connally's back. The hypothesis was to be evaluated by determining whether this trajectory lay close enough to the back-neck trajectory to make it reasonable to conclude that both are consistent with the trajectory of one bullet. Necessarily, the margin of error radius for the Kennedy-Connally trajectory would have to intersect the depository at a point within the 13-foot-radius circle of probable accuracy for the back-neck wound trajectory established earlier. Ideally, of course, the two trajectories would line up precisely, but this standard was considered unrealistically high, because, as with Kennedy, Connally's position at the time of this shot could not be precisely established; moreover, each trajectory was subject to its own sources of error.

(157) In addition to the information that already had been analyzed concerning Kennedy's neck wound, derivation of this trajectory required placement of the location of Connally's entry wound to the back. At the committee's request, Connally agreed to have the position of his back wound redetermined by the Forensic Pathology Panel. His inshoot wound was described as being immediately above his right armpit. This description is essentially consistent with figure II-18. (JFK exhibit F-399.) (57)

### LOCATION OF INSHOOT WOUND IN BACK OF GOV. CONNALLY

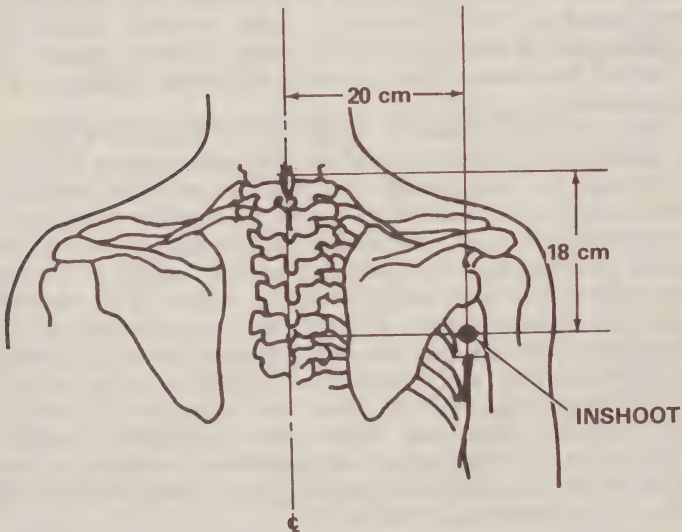


FIGURE II-18

(158) In contrast to the analyses involving Kennedy's wound pairs, the two-man wound combination required focusing on the positions of the two men relative to each other and to their surroundings in Dealey Plaza, rather than just on individual details of posture and orienta-

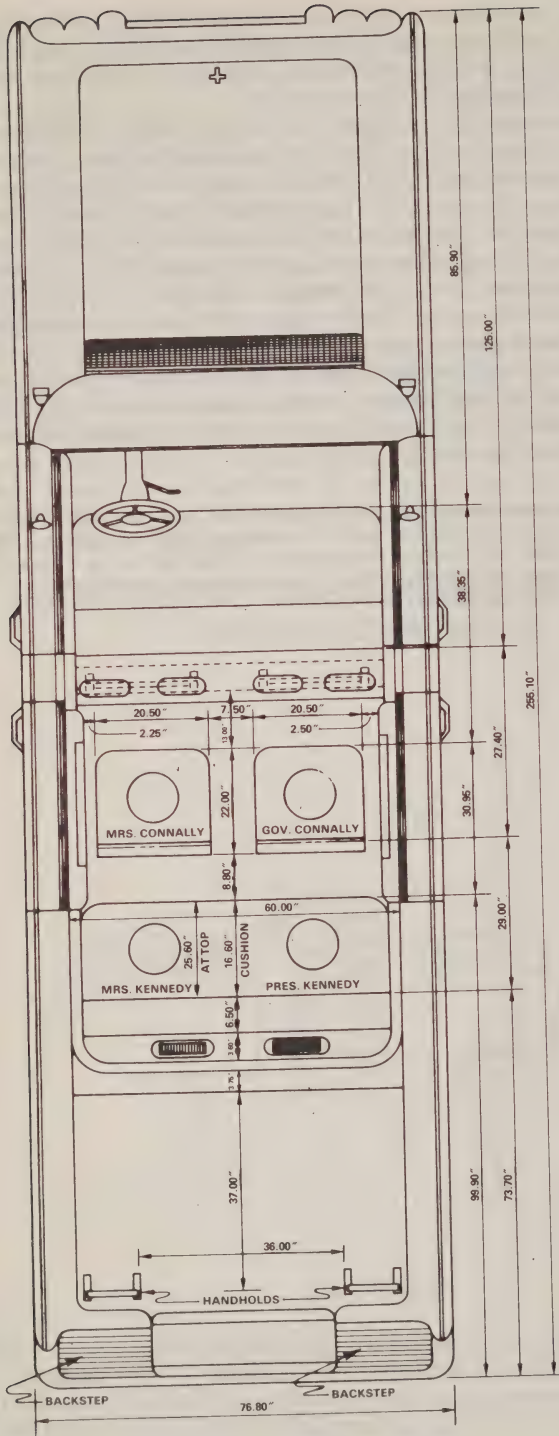
tion. This analysis was accomplished by reviewing Zapruder frames 180-207, the Croft photograph, and photographs taken by Hugh Betzner and Phillip Willis, two witnesses who were both standing behind and to the left of the Presidential limousine.

(159) Two independent determinations of the lateral relationship between the two men were made. The first consisted of a photogrammetric analysis of several pairs of pictures taken from the Zapruder movie between frames 182 and 200. These pairs were viewed together in a stereoscopic viewer so that together the pairs would project a single, three-dimensional image that could be evaluated for the relative depths of the objects that they portrayed.\* The stereo pairs clearly showed that Kennedy was seated close to the right-hand, inside surface of the car, with his arm resting atop the side of the car and his elbow extending, at times, beyond the body of the car. Connally, on the other hand, was seated well within the car on the jump seat ahead of Kennedy; a gap of slightly less than 15 centimeters separated this seat from the car door. (See fig. II-19.) (58)

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\*A similar stereophotogrammetric analysis, performed by the Itek Corp. and verified by the photographic evidence panel, indicated that in several stereo pairs Connally was sitting 10.2 to 20.3 centimeters to the left of a line extending straight forward from Kennedy. (See *Jahn Kennedy Assassination Film Analysis*, Itek Corp. (1976), pp. 43-48).





**PRESIDENTIAL LIMOUSINE (November 22, 1963)**  
**1961 Lincoln Continental — Modified**

Dimensioned from original body draft by  
Hess & Eisenhardt Co. of Cincinnati, Ohio

Scale  $\frac{3}{4}" = 1' - 0"$



FIGURE II-20

(160) The second photographic analysis, which was based primarily on the Betzner and Croft photographs, confirmed these observations. The Betzner photograph (see fig. II-20) was determined by the panel to have been taken at the time Zapruder frame 186 was exposed.\*

\*A first generation print of a photograph taken by Hugh Betzner, very close in time and from a similar vantage point as the Willis No. 5 photograph, was examined by the panel; no enhancement processing was performed as the original negative was never located. The Betzner photograph was correlated to the corresponding Zapruder frame by establishing when a Secret Service agent riding in the car behind Kennedy could be seen in both Zapruder's and Betzner's immediate line of sight.

Scrutiny of enlarged portions of the area surrounding Kennedy showed the direction in which an extension of the line of sight would travel from Betzner's lens. It goes by the upper right corner of the Secret Service handhold on the left side of the limousine trunk lid, then passes by the extreme tip of Kennedy's left shoulder, and then by the edge of the limousine's rollbar center post (to which the wind-wing window is attached) just ahead of the right rear door at Connally's



BETZNER PHOTOGRAPH



POST-ASSASSINATION LIMO PHOTOS

FIGURE II-21





FIGURE II-22

ight.\*\* This line establishes a boundary to the left of which no part of Kennedy can be seen. Nor are there visible signs of Connally's right shoulder or arm slightly to the left of this boundary (the line of sight is limited by the spectator's arm in the foreground). Therefore, Connally must be seated to the left of this line of sight.

161) With these two observations and some supportive evidence drawn from the remaining pictorial evidence, it was possible to outline Kennedy as he would have been seen from directly above. The key additional features used were his posture and inclination, which were derived from the Croft picture (see fig. II-14), and the slight indication of torso rotation to his right, derived from the Zapruder film. Next, a similar outline was drawn for Connally, with his shoulders against the backrest of the jump seat as far to the right as can be justified in view of the Betzner photograph, and turned to his right.

162) The direction in which Connally's torso was facing has been determined on the basis of viewing the Zapruder movie and by care-

\*\*Fig. II-21 (JFK exhibit F-136) demonstrates the Betzner photograph line-of-sight analysis. The rollbar center post has a diagonal appearance in the Betzner photograph because it is inclined inward from the side of the car toward the rollbar. See fig. II-22 for a clearer view of the rollbar post, as seen from a similar angle in a photograph taken by James Altgens on Houston St. less than a minute earlier.

ful study of a particularly clear stereo pair taken from the movie. The estimates of the angle of his twist vary from  $30^{\circ}$  to slightly over  $45^{\circ}$ . The two outlines show the positions of the men relative to one another. (See fig. II-23.) Connally cannot have been sitting very far to the left of this position in view of his location in Zapruder frame 190. (See JFK exhibit F-226.)

## RELATIVE POSITIONS OF PRESIDENT KENNEDY AND GOVERNOR CONNALLY AS DEDUCED FROM PHOTOGRAPHIC EVIDENCE

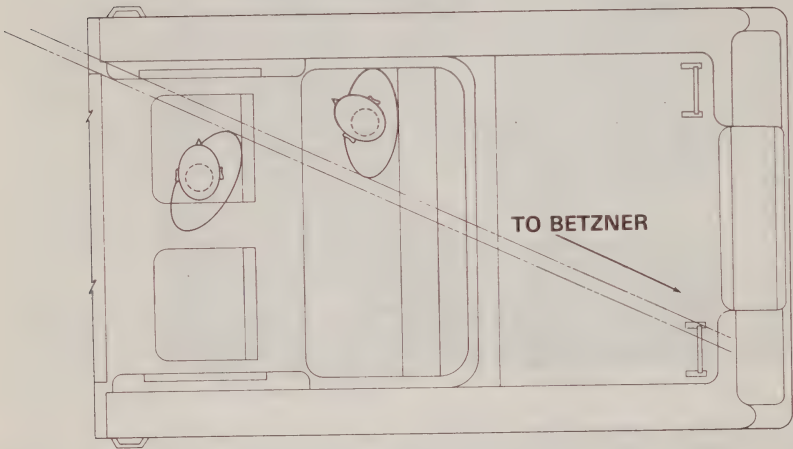


FIGURE II-23

(163) The point-to-point distance between Kennedy's neck and the part of Connally's back that was wounded was determined photographically in the Croft photograph to be approximately 60 centimeters. The height differential between the two was determined in a similar manner to be 8 centimeters.\*

(164) Using the lateral and longitudinal relationships, given the limousine as the frame of reference (see fig. II-23), the direction in which the bullet was found to have been moving from the rear was  $12.7^{\circ}$  from right to left relative to the midplane of the car. The direction of the trajectory was thereby determined by drawing a line at a  $12.7^{\circ}$  angle relative to the car and extending it to the rear until it intersected the first building that it encountered—the Book Depository, at a point approximately 2 feet to the west of the southeast corner of the building, using Zapruder frame 190 for the moment of impact. (See fig. II-24.)

\*The appearance of an even greater height difference between the two men as depicted in the Croft photograph, resulted from the more inward position of Connally in the car and the slightly downward line of sight from Croft's camera.

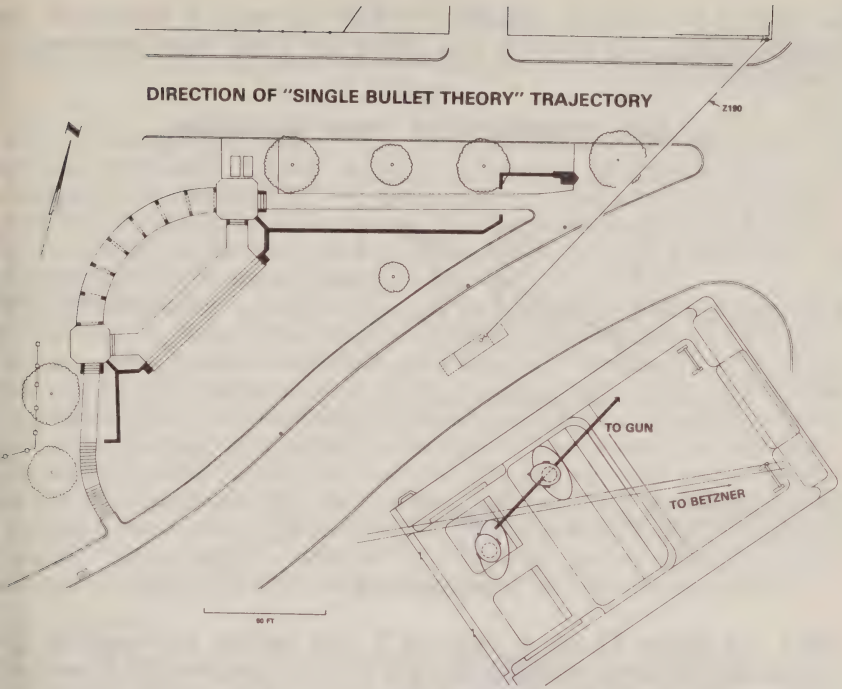


FIGURE II-24

165) In deriving the slope of the trajectory, the difference in height between the two wounds, the 60-centimeter distance between them, and the inclination of Elm Street, were taken into account. Kennedy's neck wound was 1.1 centimeters below his first thoracic vertebra; his forward inclination lowered the wound an additional 2.4 centimeters. Connally's inshoot wound was 18 centimeters below his first thoracic vertebra. Thus, if the men had been sitting so that the tops of their heads were at equal heights, Kennedy's wound would have been 14.5 centimeters higher than Connally's.\* Then, taking into account that Kennedy was seated approximately 8 centimeters higher than Connally (as observed in the Croft photograph), Kennedy's wound is found to have been 22.5 centimeters higher (14.5 plus 8 centimeters) than Connally's relative to the car. This height difference over a distance of 60 centimeters (point-to-point distance between the wounds) yields a downward slope of about  $22^\circ$  from Kennedy's wound to Connally's. Finally, accounting for the  $3^\circ$  slope of the street, the slope of the trajectory is found to be  $25^\circ$ .

166) This means that the bullet was traveling at an angle of  $25^\circ$  below true horizontal as it passed forward from Kennedy's neck to Connally's back.\*\* Using the position of the men at the time of Zapru-

\*This analysis makes the assumption that the distance in each man from the top of his head to his first thoracic vertebra is approximately the same.

\*\*This slope is  $2^\circ$  steeper than described in testimony before the committee on September 12, 1978, because the former was based on a 6-centimeter height difference instead of 8 centimeters, as presently interpreted.



der 190, if this line is extended toward the rear, it intercepts the depository building about 9 feet above the sixth floor windowsill.\* (See fig. II-25.)

#### SLOPE OF "SINGLE BULLET THEORY" TRAJECTORY

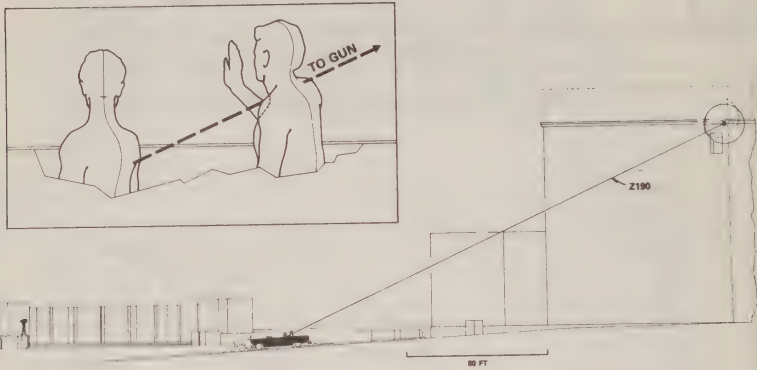


FIGURE II-25

(167) In figure II-25, a circle of 7 feet radius, representing the estimated minimum reasonable margin of error, has been drawn around the intercept point. It is smaller than those of the other two trajectories simply because the distance between the two wounds (60 centimeters) is more than four times as great as that for the back/neck case (14 centimeters) and five times that for the fatal bullet (11 centimeters). This longer baseline distance admits greater error in wound location and body position, while yielding superior accuracy. The eastern border of the error circle is somewhat better fixed than the western because the right-most position of Connally was better defined than the left-most.

(168) The consistency of the single-bullet theory trajectory with the back/neck shot trajectory described earlier is illustrated by their similar direction and slope. Note that the intercept point of the single-bullet theory trajectory at the Texas School Book Depository lies very close to the margin of error circle established for the back-neck case. Indeed, the two error circles overlap substantially. (See figs. II-17 and II-25.) Clearly, this analysis supports the single-bullet theory. The reliability of this trajectory in indicating the position of the gunman would be less if it could be shown that the bullet had been deflected as it passed through Kennedy's tissue. Nevertheless, the evidence indicates that the bullet passed near, but did not strike, the right lateral processes of the seventh cervical and first thoracic vertebrae (nor any other bony matter). (59) Consequently, the deflection, if any, was probably negligible.

\*This result differs somewhat from the testimony given before the committee on September 12, 1978, because the adjustment in the height differential between the two men affected the ultimate determination of trajectory slope.

## ADDENDUM A

## CALIBRATION PHOTOGRAPHS OF THE REPLICA OF PRESIDENT KENNEDY'S HEAD

(169) Photographs of Kennedy taken immediately before each shot provide invaluable, albeit imperfect, records of his position and orientation at the time of the assassination. The quantitative interpretation of these photographs was facilitated through detailed comparisons with calibration photographs taken of a full-scale replica of Kennedy's head, upper torso, and arms.

(170) Calibration photographs may be defined as photographs of a replica that is geometrically and texturally representative of a subject; they are taken under controlled conditions and are used to facilitate quantitative interpretation of photographs of the real subject that were taken under uncontrolled circumstances. Requirements for a good calibration photograph include: accuracy of the replica, photographic distortion similar to that in the real-life photograph under study; comparable positions for the camera and replica; and comparable lighting distribution. The calibration pictures should have somewhat superior photographic qualities in terms of spatial resolution and contrast so that error will not be introduced into the interpretation.

*Head replica*

(171) To maximize the accuracy of the replica, the Aeromedical Research Institute of the FAA's Aeronautical Center worked with a group of high-quality photographs from the National Archives. Using dimensions obtained from well characterized X-rays of Kennedy's head taken shortly before the assassination, the size and proportions of his skull and the thickness of overlying tissue (front and rear) were established. Modeling clay was applied to a standard plaster skull until the form of his head was duplicated in many aspects. To achieve improved photographic realism, artificial eyes and a wig were added. The head was then mounted on the neck of a standard FAA anthropometric dummy.

*Simulation of lighting and environment*

(172) A single studio light was used to simulate the Sun, with two small studio floodlamps to augment the illumination by the studio sky-light of the figure and the neutral background. At the time of the first shot, Kennedy had been facing west. The spotlight was accordingly positioned to the model's left. It was placed about  $36^\circ$  above horizontal from the head, a position comparable to that of the midday November sun. Similar lighting was arranged for the head-wound shot. In this case the elevation of the spotlight (Sun) was about  $56^\circ$ , compensating for the erect placement of the head on the dummy, and it was placed nearly straight in front because Kennedy had been facing south.

(173) Camera stations—the various points from which the dummy could be photographed—were marked out on the studio floor in an arc eight feet from the bridge of the model's nose. Two plumb bobs were suspended beside the figure to provide a precise vertical and angular reference respectively. Beads were installed on each plumbline at a point level with the bridge of the dummy's nose. The elevation of the camera was varied to achieve the desired angles of elevation relative



to the dummy. (This caused the actual distance between the camera and the dummy to change slightly.)

(174) Once the camera stations were established, a series of photographs was taken at varying elevations from each station, with the location of each photograph recorded. The pictures were then compared with an enhanced photograph of Zapruder 312. (See fig. II-8.) The goal was to determine the angular orientation of Kennedy's head relative to his surroundings in Dealey Plaza. Since the positions of the Zapruder and Nix cameras, with which the best pictures had been taken, were known, only the position angles relative to each camera's line of sight and to vertical references visible in the respective pictures had to be found.

(175) The relative positions of the features of Kennedy's head varied with the viewing aspect. In Zapruder frame 312, part of Kennedy's nose was obscured by his right cheek because his head was turned slightly away from the camera. His right ear appears slightly forward of where it would have been had he not been facing slightly away. His cheekbone and ear appear slightly elevated in Zapruder frame 312 as the camera was, in effect, viewing the President from slightly "below" because of the inclination of his head to the left.

(176) All these relationships among features were accounted for simultaneously during comparison with the calibration photographs. Serious impediments to accurate interpretation of the photograph were occasioned by the extremely complicated background to the President's face resulting from Mrs. Kennedy's pink suit and dark blue blouse and by the interior surface of the left side of the limousine. These problems were overcome in part by the use of a computer-enhanced version of Zapruder frame 312. (See fig. II-8.)

## ADDENDUM B

### CORRELATING TRAJECTORY TO THE ACOUSTICS RESULTS: TRAJECTORY OF HEAD-SHOT WOUNDS BASED ON ZAPRUDER FRAME 327

(177) The acoustics analysis indicates that four shots were fired at the Presidential limousine with the first, second, and fourth shots coming from the Texas School Book Depository and the third from the grassy knoll. (60) Given these findings, as well as the timing of the shots, approximately 1.6, 6, and 0.7 seconds apart, Zapruder frame 312, which immediately precedes the frame that shows the fatal head shot, theoretically could be the time of impact of either the third or fourth shot of this sequence. (61)\* If it was the fourth shot, the third shot would have had to impact (if it had hit) approximately at Zapruder frame 296; (62) if it was the third, then the fourth shot would have had to impact (if it had hit) approximately at Zapruder frame 327. (63)\*\* (See illustration 33a, fig. II-26.)

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\*The first two shots are spaced only 1.6 seconds apart. Consequently neither of these shots could have caused Kennedy's fatal head wound, since it is apparent that at least by Zapruder frame 224, Kennedy and Connally are already reacting to their earlier wounds.

\*\*The correlation between the acoustics tape and the Zapruder film indicates that this shot would have occurred approximately at Zapruder frames 328-329. See pars. 108-109 *supra*.





FIGURE II-26

(178) The acoustics, medical, ballistics, and neutron activation analyses, taken together, establish that a shot from the Texas School Book Depository struck the President's head. (64) The head shot trajectory analysis based on Kennedy's orientation and location at Zapruder frame 312 assuming this to be the fourth shot fired is consistent with this. Nevertheless, the committee decided to examine the possibility that the fourth shot fired from the Texas School Book Depository impacted at Zapruder frame 327 and that the third shot, fired from the grassy knoll, was therefore responsible for destroying Kennedy's head at frames 312-313.

(179) A trajectory analysis was undertaken based on Kennedy's orientation and location at Zapruder frame 327.\* If the trajectory were found to go back to the alleged sniper's window in the Texas School Book Depository, it would not necessarily resolve the question. On the other hand, if it did not go back to that location, the conclusion could be drawn that frame 312 was, in fact, the fatal fourth shot which struck Kennedy's head. This conclusion would have to be drawn because the medical, ballistics, and neutron activation analyses, taken together, indicate that the bullet which struck Kennedy's head was fired from the Texas School Book Depository. If the trajectory analysis indicates that this particular bullet could not have impacted at Zapruder frame 327, then the shot must have occurred at Zapruder frame 312, as the trajectory analysis for that frame (described above) does point in the vicinity of the sixth floor window.

\*At the time that this trajectory analysis was undertaken, the preliminary correlation of the fourth shot (based on a third shot at approximately frame 312) was at Zapruder frame 327. Frame 327 was exposed less than 1/18 of a second before frame 328. Kennedy's position did not change noticeably during this interval. Therefore, any difference in resulting trajectory would not be significant.

(180) While precisely the same analytic techniques were employed as those used earlier for the head wounds at Zapruder frame 312, various factors made the results here less precise. Even though the key photograph, Zapruder frame 327, was unenhanced, it nevertheless had good color rendition. The aspect from which Kennedy's head was viewed in this frame, however, did not permit as accurate a determination by comparison with calibration photographs as was the case with Zapruder frame 312.

(181) Little of Kennedy's face was visible, and his right ear was not distinct. In addition, the angle between the direction in which Kennedy's head was "looking" and the line between him and Zapruder's camera could, at best, only be defined plus or minus  $5^{\circ}$ . The apparent height of the camera relative to Kennedy's facial axis reference was even more poorly defined because of the absence of good visual reference points.

(182) Best estimates of these two angles, as well as an educated judgment of the degree to which Kennedy's facial axis appeared to be tilted left or right relative to level in the Zapruder frame, were achieved after careful study and comparison of calibration photographs approximating Zapruder frame 327. These angular relationships, plus the position estimated for the limousine at Zapruder frame 327 (based on an extrapolation of data on its earlier position) were then used to orient Kennedy's head relative to the surroundings in Dealey Plaza. Completing the analysis required construction of the line through the wound locations as before and extending the line toward the rear. When plotted, the line intercepts the face of the Texas School Book Depository about three-fourths of the building's length to the west of the southeast corner. (See fig. II-27.) When the slope of the line is derived as before, the line then intercepts the building's vertical plane just above the roof of the building. (See fig. II-28.)

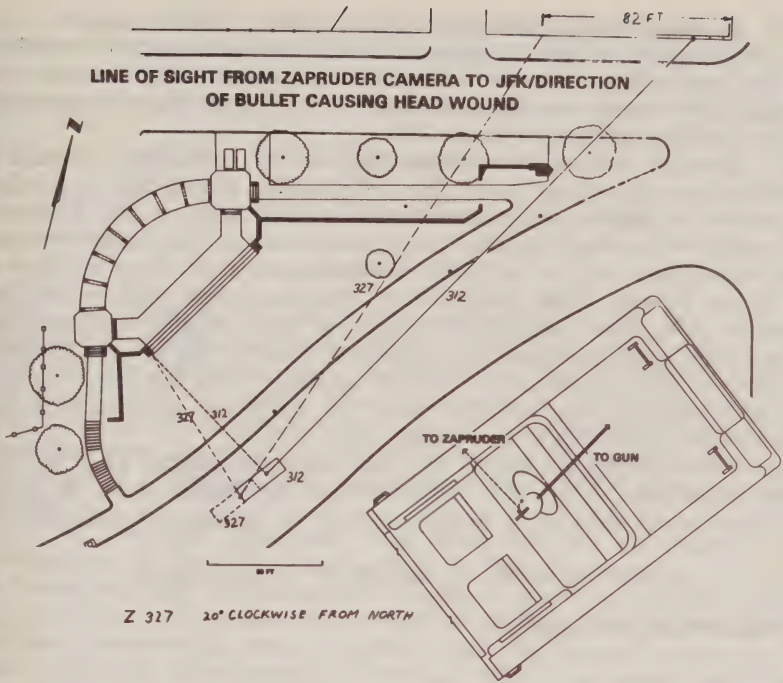


FIGURE II-27

LINE OF SIGHT FROM ZAPRUDER CAMERA TO JFK/SLOPE OF BULLET CAUSING HEAD WOUND

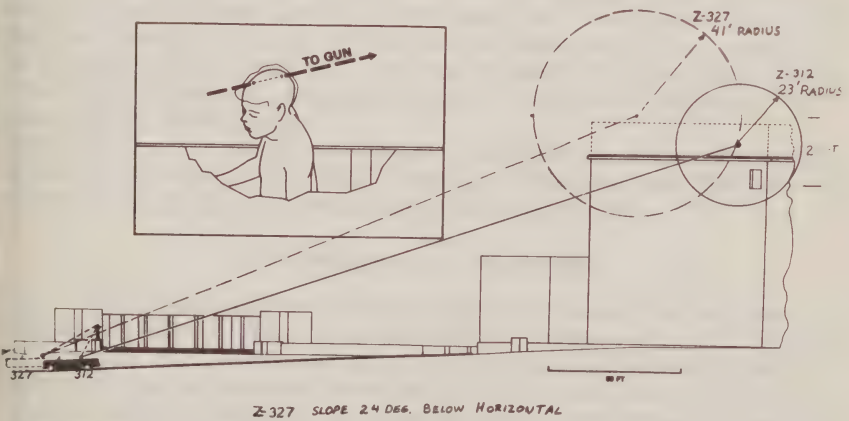


FIGURE II-28



(183) A step-by-step examination of potential errors suggests that this trajectory is subject to approximately twice the error estimated for the head shot trajectory for Zapruder frame 312 because the photographic aspect was so much more difficult and the photographic quality slightly inferior in frame 327.

(184) Despite the problems, this analysis was sufficiently precise to establish that the firing point for a Zapruder frame 327 head shot trajectory is highly inconsistent with either that of the Kennedy back-neck or the single bullet theory trajectories. The latter two are quite consistent with an origin in the southeast sixth floor window of the Texas School Book Depository, whereas, even with a 46-foot estimated minimum reasonable margin of error radius, the head trajectory for Zapruder frame 327 does not take in the alleged sniper's window. For this reason, it is highly unlikely that the head wounds were inflicted by firing a bullet from the southeast window that impacted at the time of Zapruder frame 327.

(185) Once Zapruder frame 327 has been eliminated as a possible fourth shot fired from this window, the conclusion must be made that this fourth shot must have occurred at Zapruder frame 312.

##### 5. PHOTOGRAPHIC EVIDENCE OF DEALEY PLAZA

[See pars. 241-346 *infra*.]

### III. THE ASSASSIN

#### A. *The Alleged Assassination Weapon\**

##### 1. INTRODUCTION

(186) The Warren Commission concluded that CE 139, a Mannlicher-Carcano rifle, was used to assassinate President Kennedy. (65) This rifle was linked by the Commission to Lee Harvey Oswald by both fingerprint and cloth fiber analysis, and by two photographs taken in Oswald's backyard that depict him holding the weapon. (66) These findings, however, have been questioned on the basis of observations relative to postassassination photographs of the alleged murder weapon.

(187) It has been observed that when various postassassination photographs of the rifle are enlarged, so that the images of the rifle are the same length, the respective images do not coincide. One picture may show the rifle as having a longer barrel and shorter stock than another photograph, and frequently the component parts do not align. (67) The Photographic Evidence Panel was asked to address this issue and to attempt to determine whether CE 139 could be photographically linked to Lee Harvey Oswald.

##### 2. ISSUES

(188) *a.* Are the dimensions of CE 139, the alleged murder weapon that is in the National Archives, consistent with the dimensions of the rifle that Oswald is shown holding in the backyard pictures and with the alleged murder weapon, purportedly seized by the Dallas Police Department after the assassination, that is shown in numerous postassassination photographs?

(189) *b.* Can CE 139 be established to be both the same weapon that Oswald is shown holding in the backyard pictures and that was the subject of numerous postassassination photographs?

##### 3. MATERIALS AND PROCEDURES

(190) The Photographic Evidence Panel reviewed the analysis that asserted that the relative dimensions of the rifle(s) depicted in these photographs were inconsistent, and perceived immediately that this analysis failed to consider the effect of perspective on the manner in which an image is depicted in a photograph. The camera lens projects an image of the three-dimensional world onto a two-dimensional film plane. This projection usually causes parallel lines in space to be

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\* This section was prepared under the direction of C. S. McCamy and Cecil W. Kirk; technical appendices by McCamy and Kirk are included. For related public hearing testimony, Sept. 14-15, 1978, see HSCA-JFK Hearings, vol. II, pp. 349, 397.

imaged as converging lines, and causes equally spaced intervals on a line that recedes from the camera to be imaged progressively shorter along the receding line.

(191) When a long object, such as a rifle, is tilted toward the camera axis so that one end is farther away than the other, the nearer parts are imaged larger relative to the central parts and the more distant parts are imaged smaller. The degree of difference depends on the angle of tilt. This effect is illustrated in figure III-1. (JFK exhibit F-389). Where the rifle is represented by a straight line and the camera is represented by the two essential parts, the lens and the film. Point A is at one end of the rifle, point B is at the center, and point C is at the other end. The size of the image can be found by assuming that light passes straight through the center of the lens. (68) Light from A goes to A', from B to B', and from C to C'. Figure III-1 demonstrates that although the length from A to B equals the length from B to C, the length from A' to B' is less than half the distance from B' to C'. The photographic effect of tilt attributable to perspective is further demonstrated by figure III-2 (JFK exhibit F-207.) where five photographs of one particular rifle depict its relative dimensions differently, depending on the manner in which the weapon was tilted.

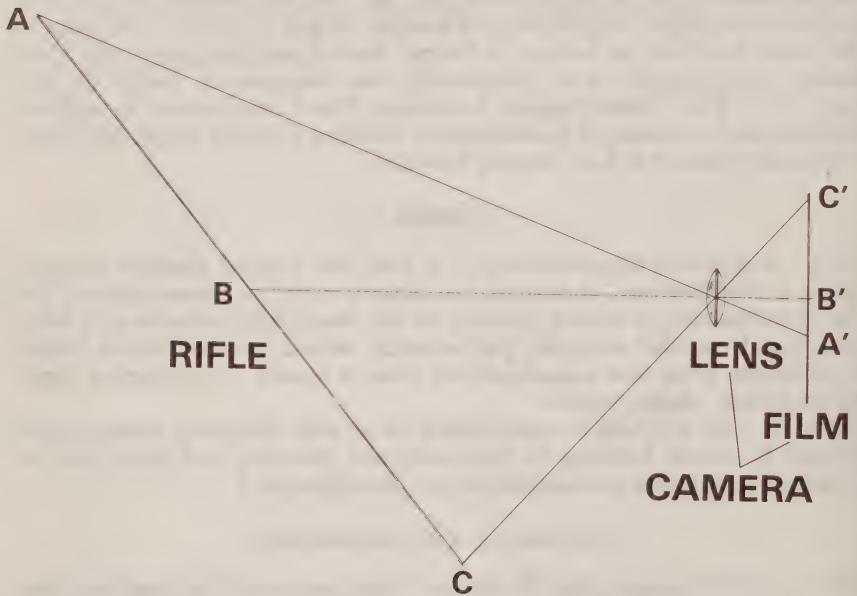


FIGURE III-1.—Photographic effect of rifle tilt.



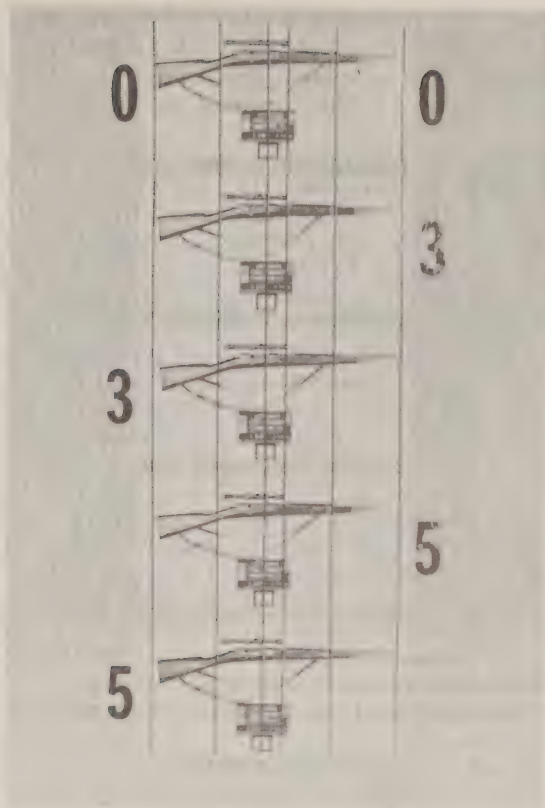


FIGURE III-2.—Effect of rifle tilt on apparent length.

(192) Realizing that the failure to consider the effect of tilt was probably responsible for the observed discrepancies, the Photographic Evidence Panel conducted a study that took the tilt factor into account. In this study the tilt angle, distance from rifle to lens and distance from lens to film\* were found that would bring the images of the two ends of the rifle and the rear flat of the rear sight into conformance with the proportions of the Archives rifle. Then, using the same constants, the locations of 10 other points on the rifle were computed from distances measured on the photographs. The two end points of the rifle and the rear sight served as anchor points for the calculation, and consequently were not regarded as measured values. Ten other points were measured for each of 12 photographs on which the points were visible. The mean value was computed for each point. The average deviation of the values from the mean of each point was computed, and the deviation of the mean value from the value for the Archives rifle was computed.

(193) When the tilt was thus taken into account, the proportions of all the rifles photographed matched the proportions of CE 139

\*These factors provided the mathematical basis for photogrammetric computations that brought these photographic images of the rifle into proportional conformance with the Archives rifle.

remarkably close. The precise procedures followed and calculations employed are set forth in the appendix to this report in a manner that can be duplicated by any competent mathematician. The photographs that served as the basis for this analysis are listed in table 1 of the appendix.

(194) In addition, 21 photographs were taken of the rifle in the National Archives in Washington, D.C. on April 18, 1978. The point of view and type of illumination were varied to simulate some of the conditions under which the rifle had been photographed at the time of the assassination. See figures III 4a-u in appendix. These photographs were then compared with the preceding pictures taken in 1963 for the purpose of determining whether any similar identifying marks could be found on the rifle depicted in both sets of photographs.

(195) It was, of course, understood that not all marks would show on all of the pictures because a given picture shows only one view. Further, different lighting reveals different scratches and other marks. For this reason, it could not be concluded that a given mark was not on the rifle at the time of an earlier photograph just because it was not visible on the photograph. The 22 identifying marks that were detected and the photographs taken in 1963, in which they are shown are set forth in table 7 of the appendix. Only one of these, the largest and most prominent, a gouge mark on the rifle's forestock, was visible on any of the backyard pictures. Nevertheless, this mark was considered sufficiently distinctive to be a reliable identifying feature. See addendum D for a discussion of random patterning.

The panel's complete analysis regarding this issue is set forth in the appendix.

#### 4. CONCLUSIONS

(196) *a.* A comparison of the relative lengths of parts of the alleged assassination rifle that is in the National Archives with corresponding parts of what purports to be that rifle as shown in various photographs taken in 1963 indicates that the dimensions of the rifle(s) depicted are entirely consistent. *b.* A comparison of identifying marks that exist on the rifle as shown in photographs today with marks shown on the rifle in photographs taken in 1963 indicates both that the rifle in the Archives is the same weapon that Oswald is shown holding in the backyard picture and the same weapon, found by Dallas police, that appears in various postassassination photographs.

### ADDENDUM

#### REPORT ON AN EXAMINATION OF PHOTOGRAPHS OF THE RIFLE ASSOCIATED WITH THE ASSASSINATION OF PRESIDENT JOHN F. KENNEDY \*

##### *Introduction*

(197) The alleged assassination weapon was the subject of many photographs. An hour or so after President Kennedy was shot and killed on November 22, 1963, the Dallas police found a rifle in the Texas School Book Depository. (69) The police photographed the rifle where it was found. During the search of the building, a 16-millimeter motion picture was taken by Thomas Alyea of television station

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\*This section was prepared under the direction of C. S. McCamy.

WFAA. This motion picture film depicts the rifle at the time that it was discovered by the police.(70) A police officer carried the rifle from the building and, as he walked east on Elm Street and across Houston Street, reporter Allen, of the Dallas Times Herald, took a series of about seven pictures in rapid succession.(71) As the rifle was carried through the halls of the police station, it was held overhead for reporters to see. Numerous photographs were taken at that time. During the investigation, both the Dallas police and the FBI photographed the rifle a number of times in their photography labs.(72) (198) Among Oswald's personal effects, the police found photographs depicting Oswald standing in his backyard, holding a rifle that looked like the rifle found in the book depository. These photographs were among the evidence considered by the Warren Commission. (73) (199) Since that time, a number of authors have reexamined the evidence and raised questions about the conclusions drawn by the Warren Commission. It has been observed that when some of these photographs are enlarged so that the various images of the rifle are the same length, the images do not coincide. The proportions of the lengths of images of component parts of the rifle do not match. See e.g. III-5 (JFK F-208) [White exhibit]. One picture may show the rifle as having a longer barrel and shorter stock than another picture, or different components of the rifle simply do not align.(74)





FIGURE III-5.—White Testimony Exhibit.

(200) Early in 1978, at the request of the committee, photographic panel member C. S. McCamy, undertook a study of this evidence. He studied two aspects of the evidence: (1) A comparison of the relative lengths of parts of the rifle, shown in various photographs taken in 1963, to the corresponding dimensions of the rifle now in the National Archives in Washington, D.C.; and (2) a comparison of identifying

marks shown on the photographs taken in 1963 with those shown on photographs he made of the rifle now in the National Archives. Both lines of investigation revealed facts that support the conclusion that the same rifle is depicted in all of the pictures examined. The study of proportions offers strong evidence that the rifle (or rifles) photographed is (or are) of the same kind. The comparison of identifying marks offers strong evidence that only one rifle is involved. The claims of gross mismatch are clearly refuted.

### *Relative Length Comparisons*

(201) The artist knows that parallel lines in three-dimensional space must be depicted as converging lines on a two-dimensional representation, and that equally spaced intervals on a line must be depicted as progressively closer as the line recedes from the viewer. This kind of rendering is automatically performed by the camera lens. Nevertheless, the human visual system, involving both the eye and brain, interprets photographs as though they were objects in three-dimensional space. We rarely notice the rendering of perspective in pictures, as long as the pictures look natural.

(202) The various pictures of the rifle were taken at various angles. Viewed naturally, normal perspective causes parts of an object tilted towards the camera to appear lengthened relative to those parts that recede from the camera. See figure III-1 (JFK F-389) (rifle tilt). The extent to which this phenomenon occurs is a function of the degree to which the object, here a rifle, is tilted relative to the camera. Accordingly, in order to make a valid study of an object's relative length as depicted in photographs, the tilt factor attributable to perspective must be taken into consideration. This can be done using the same type of analysis that is employed in the making of maps.

(203) Most maps are now made by transferring measurements from aerial photographs. If the camera carried by the airplane is tilted with respect to the vertical direction, the effect of perspective must be taken into account. Thus, the matter dealt with here is an everyday problem, well understood by those who practice photogrammetry, the science of using photography to measure dimensions. (75)

(204) It would have been possible to have these measurement studies done by highly automated methods in a mapping agency of the U.S. Government, but to achieve the highest degree of acceptance and popular understanding of the methods, special simplified forms of photogrammetric equations were derived and are set forth in addendum A. All measurements on photographs were made with an ordinary millimeter scale and hand magnifier, and all calculations were performed with a commonly available pocket calculator having a memory and trigonometric functions. These mathematical derivations can be followed by a typical high school mathematics teacher, and all of the operations can be repeated by anyone with adequate patience and the intelligence to do calculations. The procedures are admittedly very laborious.

(205) The photographs that were the subject of this analysis are listed in table No. 1. With the exception of the picture taken by the Federal Bureau of Investigation, these pictures are enlarged prints of small negatives. The enlargement ratio or magnification of the enlarger  $M$  is the ratio of the length  $x'$  of an image on the enlarged pic-

ture to the length  $x$  of the corresponding image on the negative:  $M = x'/x$ . From this it follows that a distance on the negative  $x$  can be computed from the corresponding distance  $x'$  measured on the enlarged print and the magnification  $M$  by the following formula:

$$x = x'/M$$

The magnification of a contact print is 1.

(206) Since the objective is to compare lengths along the bore of the rifle or lines parallel to it, it is possible to work with the simple equation for computing distances along a straight line, rather than the more general three-dimensional photogrammetric equations. In practically all cases, the line of the rifle image passes nearly through the center of the picture and almost always the rear sight is near the center. Thus figure 6 is fairly representative. The derived equations also are valid if the rifle image is displaced from this central position. In that case, the image distance derived would not be the axial image distance,\*<sup>(3)</sup> but the distance from the image of the rear sight to the rear nodal point\*<sup>(2)</sup> of the lens. The computed proportions of the rifle would not be affected.

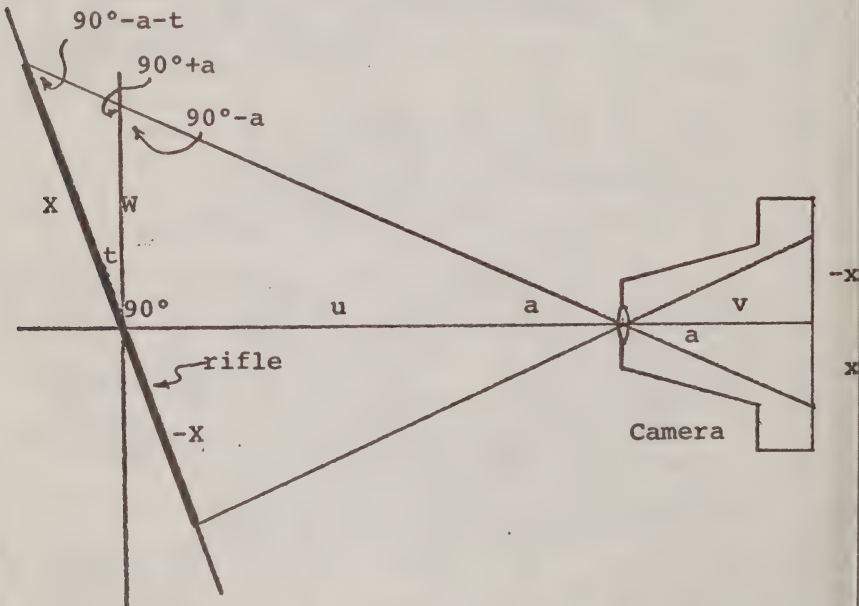


FIGURE III-6.—Geometric relationship of camera to the rifle titled at an angle  $t$ .

(207) As shown by the equations set forth in addendum A, when one point of an object is imaged at the center of a photograph, the actual distance  $X$  between that point and another point on the object may be calculated by measuring the corresponding distance  $x$  between

\*These technical terms may be defined as follows:

<sup>(1)</sup> The optical axis is the line joining the center of the lens and the center of the image area.



these points on the photograph itself. This may be accomplished if we know the angle of tilt  $t$  between the linear object and a plane normal to the optical axis  $^*(1)$  of the camera lens, the distance  $u$  from the center of the object to the front nodal point  $^{*(2)}$  of the lens, the axial image distance  $v$ , and the distance from the rear nodal point of the lens to the camera image. The equation is:

$$X = \frac{ux}{v \cos t - x \sin t}$$

If we know  $u$  and the focal length  $^{*(4)}$  of the lens, we can compute  $v$ , using the following equation:

$$v = uf / (u - f)$$

(208) In the present case, neither the distance  $u$  from the rifle to the camera lens, nor the angle of tilt  $t$ , nor the axial image distance  $v$ , is usually known. Most of the information needed to compute a distance  $X$  on the photographed rifle from a distance  $x$  on the negative is lacking. Nevertheless, the objective is not to compute such lengths; rather, it is to compare relative proportions of the parts of rifles photographed with the proportions of parts of the rifle in the Archives. To accomplish this, it is only necessary to scale the length of each rifle photographed to the length of the rifle in the Archives. The tilt angle  $t$  that makes the ratio of the length from the rear sight to muzzle and the length from rear sight to butt is the same as the corresponding ratio on the Archives rifle.\* The tilt angle  $t$  is found by the following equation, which is based on the scaling described:

$$\tan t = \left( \frac{X_2}{x_2} - \frac{X_1}{x_1} \right) \frac{v}{X_2 - X_1}$$

where:  $t$  is the tilt angle

$X_2$  is the length on the Archives rifle from rear sight to one end,  
 $x_2$  is the length on the negative image from rear sight to one end,  
 $X_1$  is the length on the Archives rifle from rear sight to the other end,  
 $x_1$  is the length on the negative image from rear sight to the other end,  
 and  $v$  is the axial image distance (lens to film)

The subscript 1 is assigned to the distance corresponding to the end of the rifle tilted away from the camera, and 2 is for the end tilted toward the camera. All measurements were from the vertical plane of the rear sight.

<sup>(2)</sup> The front nodal point is the point of view from which the scene is imaged by the camera. The rear nodal point of the lens is the corresponding point in image space. The ray of light from the rear nodal point of the lens to an image point is parallel to the ray from the corresponding object point to the front nodal point of the lens.

<sup>(3)</sup> The axial image distance is the distance along the optical axis from the rear nodal point of the lens to the center of the image area.

<sup>(4)</sup> The focal length is the axial image distance when the camera is focused on an infinitely distant object.

\*It may be mistakenly argued that this analysis seems to take for granted what is to be proven because the angle that is found makes the 2 ends and the middle of the rifle image correspond to the proportions of the rifle in the Archives. Nevertheless, once the angle of tilt and the distances are found, 10 other distances are computed using the same equation. The degree to which these 10 distances correspond to distances on the Archives rifle is the basis for determining whether the rifle photographed has the same proportions as the Archives rifle.

(209) As one looks at a photograph, depending on the degree of tilt, it may or may not be obvious whether the muzzle was tilted away from the camera or toward it. There is a mathematical test that can be applied to the measurements on the photograph to determine which way the muzzle was titled, assuming that the photographed rifle does, in fact, have the same proportions as the Archives rifle. The sight-to-muzzle length divided by the sight-to-butt length of the rifle in the Archives is 465.8/553.0. If the corresponding ratio for lengths measured on the photograph is less than this number, the muzzle was foreshortened because it was tilted away from the camera. If the ratio is greater, the muzzle was tilted toward the camera.

(210) For the sake of convention, each measurement of sight-to-muzzle and sight-to-butt length was assigned a positive or negative number, depending upon which way these respective parts were tilted in relation to the camera. The respective part tilted away from the camera was assigned the positive number and the respective part tilted toward the camera was assigned the negative number. See table 3.

(211) If the tilt angle  $t$ , the axial image distance  $v$ , the length  $X_1$ , on the Archives rifle, and  $x_1$  on the photographic negative are known, it is possible to compute the distance  $u$  from the center of the object (the rear sight of the rifle photographed) to the camera lens:

$$u = \frac{X_1}{x_1} (v \cos t - x_1 \sin t)$$

(212) Given these five relationships, the following sequence of operations were used to compare a photographed rifle with the rifle in the Archives. The lengths of many parts of the rifle in the Archives were measured. The points to which measurements were made are named in table 2 and the measured distances are given in the first column of table 5. All lengths were measured along lines parallel to the bore. The corresponding lengths were measured on a photograph. Twelve photographs, representative of all the photographs examined (see table 1) were selected for measurement. These measurements are given in table 3.

(213) When the negatives were available, as was the case for photographs by William Allen, Dallas Police (one instance), and McCamy, the enlarged magnification was computed from material deleted, see text measurement of the distance between frame borders depicted on the enlargement and measurement of the actual distance between frame borders by the Geological Survey. In all other cases, magnification was estimated.\*

(214) The focal lengths of camera lenses were known for the backyard photograph (calibrated by the Geological Survey; see Addendum B), McCamy's photograph (calibrated by McCamy), and the Dallas

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\*Magnification, focal length, and object distance were estimated by knowing or assuming the size camera used and by visual inspection of the given print. These first estimates provided a starting point for the computations. A series of computations refined the estimates until a consistent set of values was found. If the assumed camera size were erroneous, the assumed magnification would be wrong and the axial image distance computed would be off by the same factor. These effects would cancel, so the erroneous estimates would not affect the determination of the proportions of the rifle. It would be immaterial whether we were measuring a 2x enlargement of a negative 4 inches wide or an 8x enlargement of a negative 1 inch wide.



Police laboratory photographs (nominal focal length supplied by Dallas Police). (76) Other focal lengths were estimated by taking into account common practice at the time the photographs were made. The object distance  $u$  was measured for the McCamy photograph. In all other cases, it was estimated.

### *Sequence of Computations*

(215) 1. Based on known or estimated object distance and focal length, the first estimate of axial image distance  $v$  was computed by the second equation in paragraph 207.

2. Based on known or estimated magnification, negative image lengths  $x$  were computed from measured corresponding lengths  $x'$  on enlargements by the last equation in paragraph 205.

3. A first estimate of tilt angle  $t$  was computed by the equation in paragraph 208.

4. A second estimate of object distance  $u$  was computed by the equation in paragraph 211, based on the first estimates of  $v$  and  $t$ .

5. A second estimate of axial image distance  $v$  was computed by the second equation in paragraph 207, based on the second estimate of  $u$ .

6. A second estimate of  $t$  was computed based on the second estimate of  $v$ .

7. A third estimate of  $u$  was computed based on the second estimates of  $v$  and  $t$ .

8. The computations were done repeatedly, each time using the last computed estimates of  $t$ ,  $u$ , and  $v$ . From one computation to the next, the successive approximations changed less each time until, finally, no appreciable change was found from one computation to the next. This determined the set of values of  $u$ ,  $v$ , and  $t$  that scaled the two main parts of the photographed rifle to the Archives rifle and took into account the tilt angle.

(216) Given  $u$ ,  $v$ , and  $t$ , the first equation in paragraph 207 was used to compute the lengths  $X$  of various parts of the rifle as deduced from the lengths  $x$  of corresponding parts on the negative image. The computed lengths  $X$  of the parts of the rifle could then be compared directly to measured lengths of parts of the Archives rifle. If the lengths of various parts of a photographed rifle were proportional to corresponding parts on the Archives rifle, the lengths computed by this procedure would match the lengths measured on the Archives rifle.

(217) In performing these calculations, the same scale for all measurements was used. It was uncalibrated except that the centimeter divisions were checked for consistency. The rifle was measured with an uncalibrated steel metric tape.

(218) The results of these calculations are set forth in tables 4 and 5. In each instance, the relative lengths of the corresponding measured parts were found to be proportional, and the resulting computed lengths matched very closely. In performing the computations, it is important to bear in mind the sign of  $X$  and  $x$ . They are negative when referring to the part of the rifle tilted toward the camera. In particular, the second term in the denominator of the first equation in paragraph 207 is a negative quantity toward one end of the rifle and positive toward the other.

(219) The two endpoints of the rifle and the rear sight are anchor points for the analysis, so they should not be regarded as measured



values. Each of 10 other points was measured by the technique given for all of the 12 photographs on which the points were visible. The mean value was computed for each point. The average deviation of the values from the mean of each point was computed. The deviation of the mean value from the value for the Archives rifle was computed. All of the data are given in table 5.

(220) The computed distances were within 3 or 4 millimeters of the corresponding distances on the rifle in the Archives; this reflects an approximate error of 1 percent between the actual lengths on the rifle and the lengths computed from the photographs. A comparison of tables 3 and 5 shows that the computed distances involved multiplication factors ranging from 4 to 17 times the distances measured on the photographs. Thus, the errors of measurement were magnified by these amounts. Since measurement errors of a small fraction of a millimeter should be expected, such errors would reasonably account for the deviations from the Archives rifle.

(221) The agreement of the data clearly contradicts the claims of gross discrepancies in proportions of the rifles photographed and offers strong evidence that the rifle or rifles photographed had the same proportions, within reasonably expected experimental error. The only way that there could have been a rifle depicted in these photographs with proportions substantially different from those of the Archives rifle, and yet matched when mathematically oriented at the computed angle  $t$  and distance  $u$ , would have been if someone deliberately manufactured a special rifle with all dimensions distorted in precisely the right way to appear to match when viewed at some angle other than  $t$ . In that case, it would have been necessary to align this specially contrived rifle and the camera very meticulously at the time the pictures were made. It is highly unlikely that anyone could have perpetrated such a ruse without detection in front of the Book Depository or in the halls of the Dallas Police Station a few hours after the assassination of the President. Aside from this possibility, the method used would show close agreement only if the photographed rifle had the same proportions as the Archives rifle, within reasonably expected experimental error, and, of course, this is not what has been claimed by Warren Commission critics. (77)

(222) In making the measurements, it is necessary to give some attention to perspective. The simple equations refer to a line, that is, the centerline of the bore of the rifle. They also apply to nearby lines parallel to that line. Nevertheless, if the rifle is tilted and twisted about the centerline, as shown in figure 7, the twist throws the image of the butt to the right. In making the measurements, this must be judged and the line drawn from the butt to the centerline must be angled in keeping with the perspective; this means that the solid line in figure 7, rather than the dotted line which is perpendicular to the centerline, must be used. This comes quite naturally if we let our visual sense guide us. (Notice that even in the crude drawing of fig. 7, the dotted line does not appear to be perpendicular to the centerline. This is an optical illusion. If the perspective is sensed, the solid line appears to be more nearly perpendicular.) High precision requires this technique to be used for all measurements when the endpoints are not the same distance and direction from the centerline. The case illustrated in figure 7 is an exaggeration of photograph 11 (see table 1), where the form of the butt provides a clear indication of the perspective angle.

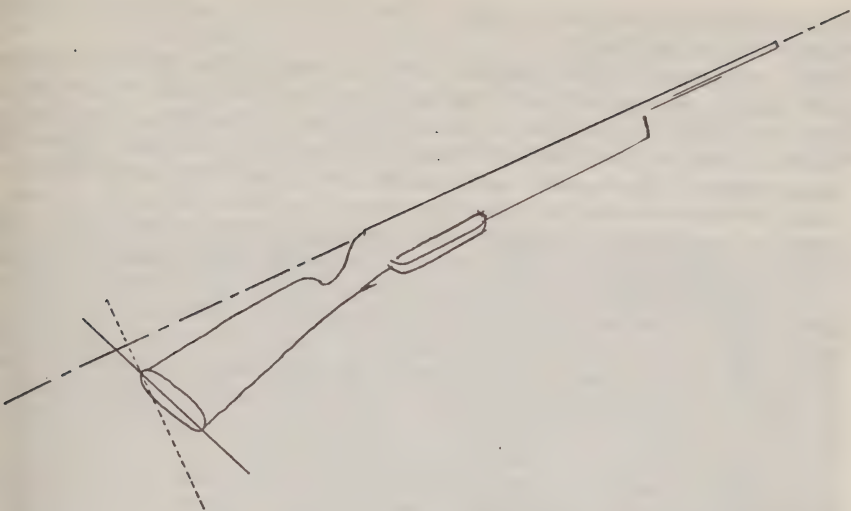


FIGURE III-7.—Taking perspective into account in measuring distances of points off the centerline of the rifle bore, such as the butt, comb, trigger, and trigger guard.

223) The backyard photograph presented some special problems. The hand obscures the exact location of the rear sight. (See fig. III-1.) A nearby groove on the outside of the chamber was visible and the rear sight was located relative to this groove. The rear sight was not entered in the photograph but the rear end of the bolt was. The analysis was done relative to the rear end of the bolt and the lengths were then translated to be zero at the rear sight for comparison with the archives rifle.

224) Vertical lines near the edge of the picture bow out very appreciably at top and bottom. This is known as "distortion." The distortion of the lens said to have been used to take this picture was measured by the Geological Survey. The image lies along the diagonals designated  $90^\circ$  and  $270^\circ$  by the Geological Survey. The reported distortion along this axis was plotted and appropriate distortion corrections were interpolated on this plot. The distortion correction was .5 mm for points 6 and 7. It was negligible for all other points. Since the distortion was positive, these amounts were subtracted from distances computed for the original negative image from measurements of the enlargement. No distortion corrections were made for other photographs or for the enlarging lenses because no distortion information about the cameras that were used to take these photographs was available. Nevertheless, since the photographs other than the backyard photograph were professionally made, the lenses probably had very little distortion.

225) In addition to the photographs of this rifle, a photograph made by the Metropolitan Police Department of Washington, D.C., of a different specimen of the same kind of rifle was examined and analyzed for the purpose of determining whether the relative properties of Malincher-Carcano rifles are necessarily identical. See figure III-8,

No. 4 and No. 5. (JFK exhibit F-206) The data are shown in the tables for picture No. 21.

(226) The metal parts coincide very well except for the rear of the bolt. In this photograph only, the bolt appears to be in the firing position. In all other photographs, it is in the cocked position. This being the case, such a discrepancy should be expected. The only point of comparison of the wooden stocks is the comb, and the computed distance to the comb on this extra specimen is outside the range of computed values of this distance on all the photographs of the Archives specimen. This suggests that there were small differences in manufacturing the wooden parts. This is borne out by the further observation that two angles on the butts are measurably different on photographs 20 and 21 by the Metropolitan Police Department. The rear line of the butt is at an angle to the perpendicular to the bore. On the Archives specimen it is  $6.5^\circ$ ; on the extra specimen it is  $10^\circ$ . The bottom straight line of the stock is at an angle to the bore. On the Archives specimen it is  $18^\circ$ ; on the extra specimen it is  $19^\circ$ .

(227) There are many sources of error not accounted for in this analysis. The distortion of camera and enlarging lenses has been mentioned. In addition, film changes size and shape during processing and subsequent to processing as the temperature and humidity change. The same may be said of paper prints. Finally, there are natural limits to the precision of measurements involving decisions as to the exact endpoints to set on, interpolation, parallax, inaccuracy of the scale used, and alinement of the scale with the center line.

Ultimately, however, when the computed distances were scaled to the photographs, the deviations from the Archives rifle amounted in most cases to a small fraction of a millimeter. It would be reasonable to expect that the effect of the potential errors cited would be of that magnitude.

### *Identifying Marks*

(228) Twenty-one photographs were taken of the rifle in the National Archives in Washington, D.C., on April 18, 1978. These photographs, figures 4a-u, are numbered from A-1 to A-21 in the upper right-hand corner. See table 6. Identifying marks are lettered on the photographs. Table 7 indicates the earlier photographs from the preceding section on which the same marks may be observed. There are 56 citations of 22 different identifying marks on the early photographs, and 13 on the photograph of the alleged assassination weapon that was recently made by the Metropolitan Police Department of Washington, D.C. The list of identifying marks includes the more prominent markings found on the photographs from the preceding section but is not exhaustive. In many cases, smaller or less prominent nearby marks are seen as well.

(229) Identifying mark L refers to the pattern of vertical lines apparently left in the horizontal groove by the woodworking operation used in manufacturing the stock. These may be regarded as several points of evidence. The mark "VE [trefoil] K" (identification mark U), the date "November 22, 1963," and "PMS" or "RMS" "November 1963", have been scratched into the butt, as shown on pictures A-6, A-10, A-11, A-16, and A-21, possibly by law enforcement officials. Only the trefoil of mark U appears on the Fort Worth Star Telegram



photograph No. 13 in table 1, but the initials in identification mark U are seen on photograph No. 15 taken by the Dallas Police Department later that day. The lighting revealing the trefoil should have revealed the initials immediately to either side of it in picture 13 if they were, in fact, there at the time that the picture was taken. None of the cited identifying marks were observed on photograph No. 21 of another specimen of the same kind of rifle.



FIGURE III-4a.—McCamy's Archives rifle photograph.



FIGURE III-4b.—McCamy's Archives rifle photograph.



FIGURE III-4c.—McCamy's Archives rifle photograph.

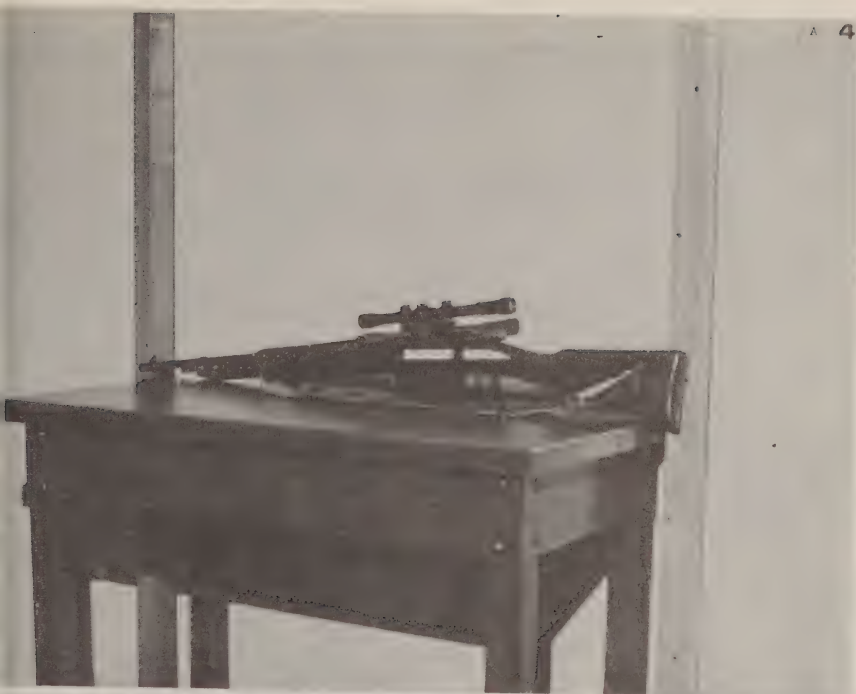


FIGURE III-4d.—McCamy's Archives rifle photograph.

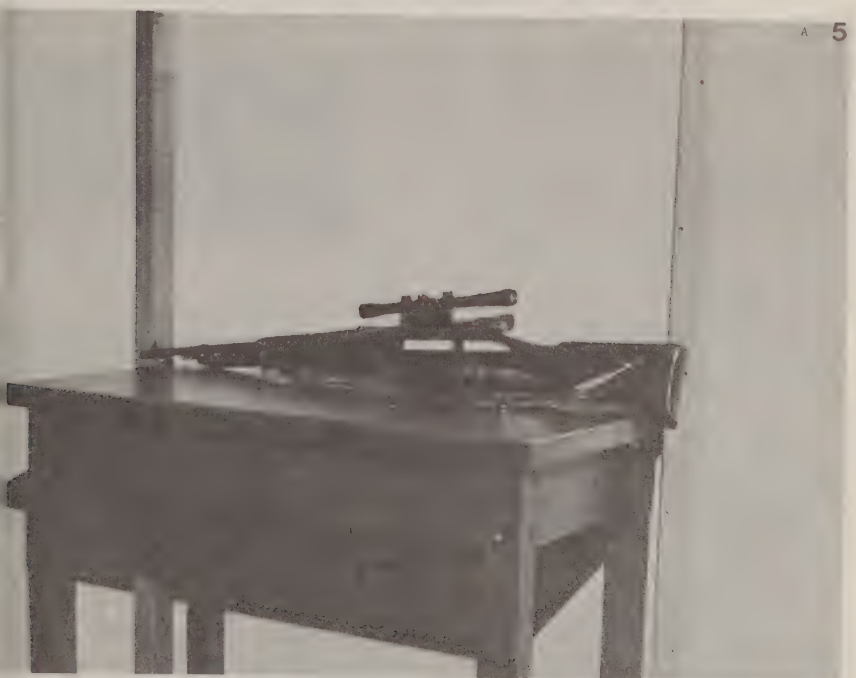


FIGURE III-4e.—McCamy's Archives rifle photograph.





FIGURE III-4f.—McCamy's Archives rifle photograph.

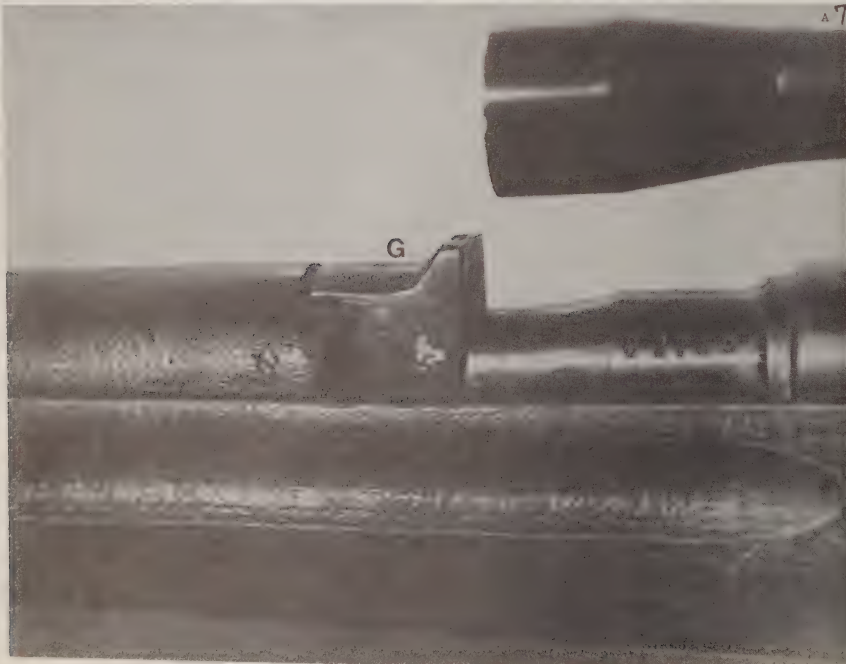


FIGURE III-4g.—McCamy's Archives rifle photograph.



FIGURE III-4h.—McCamy's Archives rifle photograph.



FIGURE III-4i.—McCamy's Archives rifle photograph.

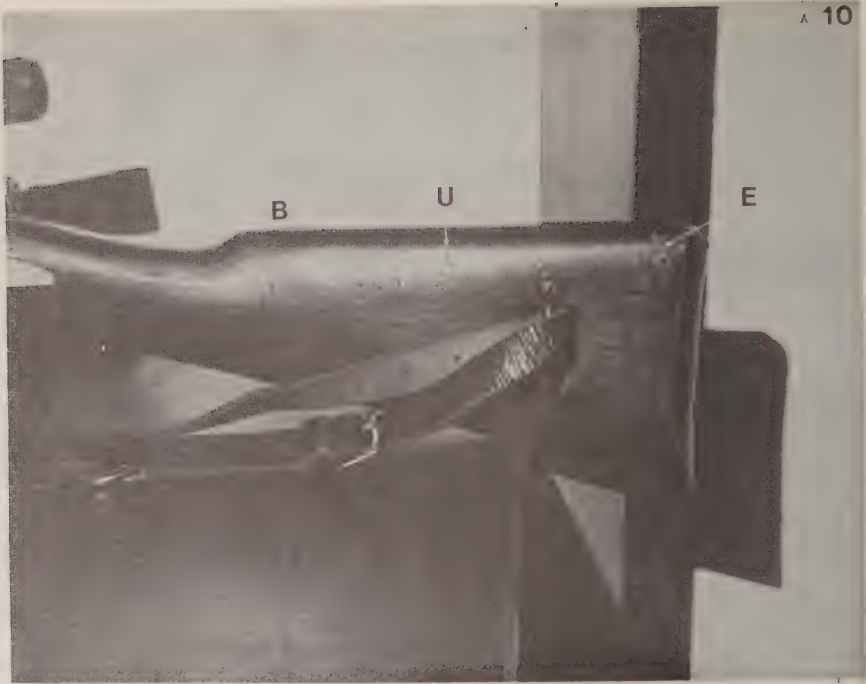


FIGURE III-4j.—McCamy's Archives rifle photograph.



FIGURE III-4k.—McCamy's Archives rifle photograph.





FIGURE III-4l.—McCamy's Archives rifle photograph.



FIGURE III-4m.—McCamy's Archives rifle photograph.



FIGURE III-4n.—McCamy's Archives rifle photograph.



FIGURE III-4o.—McCamy's Archives rifle photograph.



FIGURE III-4p.—McCamy's Archives rifle photograph.



FIGURE III-4q.—McCamy's Archives rifle photograph.





FIGURE III-4r.—McCamy's Archives rifle photograph.



FIGURE III-4s.—McCamy's Archives rifle photograph.



FIGURE III-4t.—McCamy's Archives rifle photograph.

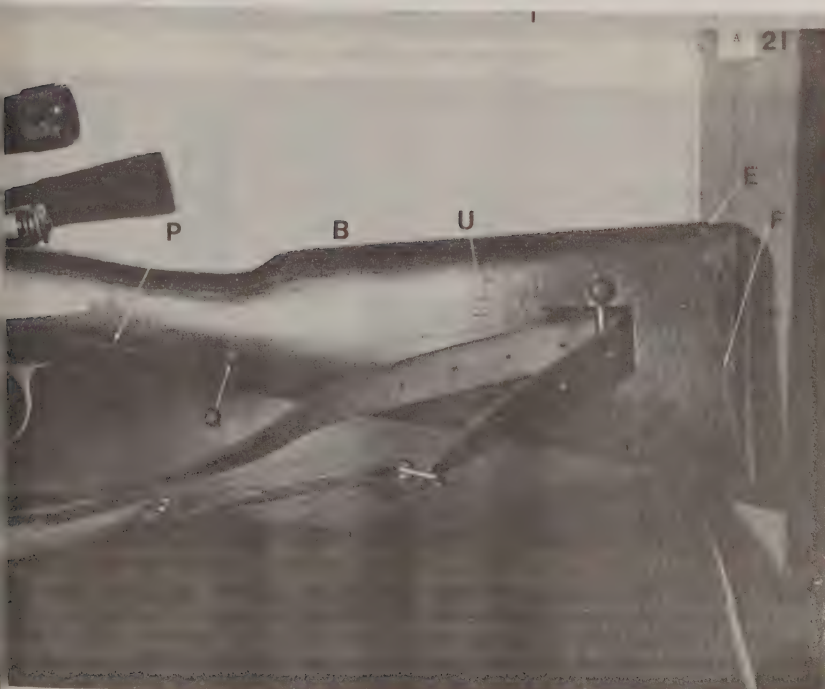


FIGURE III-4u.—McCamy's Archives rifle photograph.

(230) Significantly, the largest and most prominent mark, mark S, a gouge mark that appears on the backyard picture, also appears in the gun as it is portrayed in the Aleya movie sequence and in three other postassassination photographs of the rifle as well. See table 7. While the FBI was disinclined to testify to the Warren Commission that this gouge mark was sufficiently unique to warrant a positive identification of the assassination weapon as the same gun that Oswald is shown holding in the backyard picture, (78) the Panel's forensic photographic specialist considered this mark to be a random patterning sufficient to warrant a positive identification. See figure III-8 (JFK exhibit F-206 and addendum C).



FIGURE III-8.—(JFK exhibit F-206) Identifying mark S (gouge on forestock) considered to be a "random pattern." (See addendum D.) Clockwise from left: Enlargement of Archives rifle shows mark S (No. 1); Archives rifle (No. 2) and another Mannlicher-Carcano (No. 3)—mark S only visible on No. 2; de Mohrenschildt print of CE 133-A (No. 4) and Fort Worth Star Telegram photograph of rifle shortly after discovery (No. 5); marks visible on enlargements of both photographs.



(231) Finally, the most common misconception regarding photographic evidence is the idea that all photographs of the same object must look alike. The appearance of the image depends on level and directions of illumination, point of view, kind of film or plate, exposure, focus, and a host of other factors. Pictures A-1, A-2, and A-3 in this series were made with the camera and rifle in the same position; only the lighting was changed. Note the difference in appearance, particularly in the wooden parts. Picture A-1 is directionally lighted from the upper left, picture A-3 from the upper right, and picture A-2 was diffusely lighted from overhead. The same kinds of differences are seen in A-5 and A-6, in A-7 and A-9, in A-6, A-7, and A-8 and in A-10 and A-21. Note that mark A appears light on a dark background on picture A-1, but dark on a light background in picture A-2, simply because the lighting is different. One must be careful not to conclude that marks were not on the rifle at the time a picture was made simply because the marks are not seen in the picture.

### Conclusion

(232) 1. A comparison of the relative lengths of parts of the alleged assassination rifle that is in the National Archives with corresponding parts of what purports to be that rifle as shown in various photographs taken in 1963 indicates that the dimensions of the rifle(s) depicted are consistent.

(233) 2. A comparison of identifying marks that exist on the rifle as shown in photographs today with marks shown on the rifle in photographs taken in 1963 indicates both that the rifle in the Archives is the same weapon that Oswald is shown holding in the backyard picture, and the same weapon that was seized by Dallas Police and appears in various postassassination photographs.

TABLE 1.—PHOTOGRAPHS ANALYZED  
[In chronological order of original image]

Exhibit No. and to No.	Identification No.	Source	Description
-3a:			
0 <sup>1</sup>	133-A	Dallas Police (Oswald)	Backyard photograph.
1	HSCA 003403	Dallas Police	Rifle where found.
-3b:			
1a <sup>1</sup>	HSCA 007536	WFAA-TV, T. Alyea	Movie in book depository.
2	HSCA 003295	Dallas Times Herald, Allen 5-11	Rifle carried in street.
3	HSCA 003295	Dallas Times Herald, Allen 5-12	Do.
-3c:			
3a <sup>1</sup>	HSCA 003295	McCamy's print of above	Do.
4	HSCA 003295	Dallas Times Herald, Allen 5-13	Do.
5	HSCA 003295	Dallas Times Herald, Allen 5-15	Do.
-3d:			
5a <sup>1</sup>		McCamy's print of above	Do.
6	HSCA 003294	United Press International	(Enlargement of No. 5).
7	HSCA 003295	Dallas Times Herald, Allen 5-16	Rifle carried in street.
8	HSCA 003294	United Press International	(Enlargement of No. 7).
9	HSCA 003295	Dallas Times Herald, Allen 5-17	Rifle carried in street.
10	HSCA 003295	Dallas Times Herald, Allen 5-18	Do.
-3e: 11 <sup>1</sup>	HSCA 003356	Fort Worth Star Telegram	Rifle in police station.
-3f: 12 <sup>1</sup>	HSCA 003294	United Press International No. 1402594	Do.
-3g: 13 <sup>1</sup>	HSCA 003356	Fort Worth Star Telegram	Do.
-3h: 14 <sup>1</sup>	HSCA 003403	Dallas Police Department	Laboratory photograph.
-3i: 15 <sup>1</sup>	HSCA 003403	do	Do.
-3j:			
16	HSCA 003403	do	Do.
17		do	(Negative) laboratory photograph.
-3k:			
18 <sup>1</sup>		Federal Bureau of Investigation	Laboratory photograph.
19		McCamy	Rifle in National Archives.
-3l:			
20 <sup>1</sup>	MPD 139 4-15-78	Metropolitan Police Dept., Wash., DC	Laboratory photograph.
21	MPD 542 4-15-78	do	Laboratory photo of a different specimen of this kind.

See table 7, photographs depicting ID marks.

TABLE 2.—*Selected points on the rifle and rifle images*

(Measurements were made from the rear sight to each selected point)

1. Muzzle.
2. Front of band supporting front sight.
3. Rear of band supporting front sight.
4. Front end of bayonet mount.
5. Front end of bayonet mount ring.
6. Front end of ring over the stock clamp.
7. Front end of stock band.
8. Rear flat of rear sight.
9. Front of trigger guard.
10. Front of trigger.
11. Rear of bolt (bolt closed).
12. Comb.
13. Butt.

TABLE 3.—LENGTHS MEASURED ON ENLARGEMENTS (mm)

Point:	Photograph No.										
	0 <sup>1</sup>	3a	5a	11	12	14	15	16	17 <sup>2</sup>	18	20
1	---	---	---	---	---	---	---	---	---	---	---
2	---	---	---	---	---	---	---	---	---	---	---
3	---	---	---	---	---	---	---	---	---	---	---
4	---	---	---	---	---	---	---	---	---	---	---
5	---	---	---	---	---	---	---	---	---	---	---
6	---	---	---	---	---	---	---	---	---	---	---
7	---	---	---	---	---	---	---	---	---	---	---
8	---	---	---	---	---	---	---	---	---	---	---
9	---	---	---	---	---	---	---	---	---	---	---
10	---	---	---	---	---	---	---	---	---	---	---
11	---	---	---	---	---	---	---	---	---	---	---
12	---	---	---	---	---	---	---	---	---	---	---
13	---	---	---	---	---	---	---	---	---	---	---

<sup>1</sup>For an analysis of photograph 1a, taken by T. Alyea, which shows the rifle at the time that it was discovered by Dallas police officials, see addendum C.

<sup>2</sup>Measured on the negative.

TABLE 4.—DERIVED PHOTOGRAMMETRIC CONSTANTS

Photograph No.	Enlarger magnification M	Axial image distance v(mm)	Object distance u(mm)	Tilt angle t (degrees)
01	---	---	---	---
3a	---	---	---	---
5a	---	---	---	---
11	---	---	---	---
12	---	---	---	---
14	---	---	---	---
15	---	---	---	---

<sup>1</sup>For the analysis of photograph 1a, taken by T. Alyea, which shows the rifle at the time that it was discovered by Dallas police officials, see addendum C.



TABLE 5.—COMPUTED LENGTHS OF PHOTOGRAPHED RIFLE COMPONENTS COMPARED TO MEASURED COMPONENTS ON ARCHIVES RIFLE  
[Lengths in millimeters]

Archives rifle	Photograph No.																	21 <sup>2</sup>
	01	3a	5a	11	12	14	15	16	17	18	19	20						
465.8	465.8	465.9	465.8	465.8	465.9	465.9	465.7	465.8	465.7	465.9	465.8	465.8	465.8					
442.3	442.3	443.0	443.8	442.4	441.9	443.0	445.9	442.7	441.8	443.4	442.8	442.4	443.7					
431.0	432.7	432.9	431.7	427.1	429.9	430.7	428.1	432.2	427.4	427.3	431.9	431.2	431.4					
373.0	370.4	377.0	374.8	374.8	373.9	375.2	377.4	370.1	374.2	373.7	373.9	372.8	372.2					
353.9	353.7	356.4	357.0	356.8	356.9	353.9	356.3	353.6	354.8	355.8	355.0	354.6	354.6					
329.7	332.8	331.0	331.8	327.7	332.5	330.9	329.5	333.6	330.4	327.8	330.2	330.0	329.9					
188.4	189.9	189.4	188.2	190.5	188.2	186.3	186.4	186.3	186.8	187.8	188.2	187.2	186.8					
0	0	0	0	0	0	0	0	0	0	0	0	0	0					
66.4	68.0	68.0	67.2	67.2	68.9	67.0	69.0	70.2	64.2	66.4	67.2	66.4	68.1					
213.3	213.8	213.8	213.8	213.8	210.2	206.3	206.9	211.7	210.8	212.4	212.8	210.9	212.2					
261.8	262.0	261.8	262.0	262.0	261.1	262.9	261.8	265.1	264.7	264.7	261.2	260.4	260.4					
359.0	357.5	354.3	357.5	361.3	357.3	358.0	356.4	360.9	355.6	358.4	359.9	356.8	356.8					
553.0	552.9	553.1	553.4	552.8	553.1	553.1	552.9	553.1	552.9	553.0	553.0	553.0	553.0					

<sup>1</sup> For the analysis of photograph 1a, taken by T. Alvea, which shows the rifle at the time that it was discovered by Dallas police officials, see addendum C.

<sup>2</sup> A different specimen of the same kind of rifle.

<sup>3</sup> Bolt apparently in firing position.

<sup>4</sup> Small discrepancy between the butts of the two specimens.

TABLE 6.—*Photographs of rifle in the Archives exhibiting identifying marks*

		(McCamy) National Archives photograph No. A—
Mark :		
A	-----	12, 13, 16, 17.
B	-----	8, 10, 21.
C	-----	16.
D	-----	16.
E	-----	10, 21.
F	-----	21.
G	-----	7, 9.
H	-----	16.
J	-----	16.
K	-----	15.
L	-----	20.
M	-----	19.
N	-----	16.
O	-----	13.
P	-----	21.
Q	-----	21.
R	-----	16.
S	-----	20.
T	-----	20.
U	-----	6, 10, 21.
V	-----	19, 20.
W	-----	11.



FIGURE III-3a.—Table 7. Table 1 (photograph No. 0).



FIGURE III—3b.—Table 7. Table 1 (photograph No. 1a). (See attachment c).





FIGURE III-3c.—Table 7. Table 1 (photograph No. 3a).



FIGURE III-3d.—Table 7. Table 1 (photograph No. 5a).



FIGURE III-3e.—Table 7. Table 1 (photograph No. 11).



FIGURE III-3f.—Table 7. Table 1 (photograph No. 12).





FIGURE III-3g.—Table 7. Table 1 (photograph No. 13).



FIGURE III-3h.—Table 7. Table 1 (photograph No. 14).



FIGURE III-3i.—Table 7. Table 1 (photograph No. 15).



FIGURE III-3j.—Table 7. Table 1 (photograph No. 16).

TABLE 7.—PHOTOGRAPHS DEPICTING IDENTIFYING MARKS

Exhibit No.	Photographic No. from table 1	Identifying marks
III-3a.....	0 (backyard).....	S.
III-3b.....	1a Alyea movie.....	A, B, C, D, H, S.
III-3c.....	3a Dallas Times.....	B, E, W.
III-3d.....	5a Dallas Times.....	B, E, F, G, W.
III-3e.....	11 Fort Worth Star Telegram.....	A, C, D, G, J, K.
III-3f.....	12 United Press.....	A, D, K, L, M, N, O, S, T.
III-3g.....	13 Fort Worth Star Telegram.....	E, P, Q, part of U, W.
III-3h.....	14 Dallas Police.....	E, P, Q.
III-3i.....	15 Dallas Police.....	E, F, P, Q, U.
III-3j.....	16 Dallas Police.....	C, D, H, R, S, T.
III-3k.....	18 FBI.....	A, C, D, H, R (appears light), S, V.
III-3l.....	20 Washington Police.....	A, C, D, H, J, K, M, N, O, R, S, T, V.



FIGURE III-3k.—Table 7. Table 1 (photograph No. 18).





FIGURE III-31.—Table 7. Table 1 (photograph No. 20).

TABLE 8.—ERROR ANALYSIS

	Archives rifle (mm)	Mean value (mm)	Average deviation from mean (mm)	Difference from archives rifle
Part No.:				
1.....	465.8			
2.....	442.3	443.2	0.8	0.9
3.....	431.0	430.3	1.9	—0.7
4.....	373.0	373.9	1.6	—0.9
5.....	355.9	355.6	1.1	—0.3
6.....	329.7	330.7	1.6	1.0
7.....	188.4	187.9	1.1	—0.5
8.....	0			
9.....	66.4	67.45	1.3	1.05
10.....	213.3	210.6	1.9	—2.7
11.....	261.8	262.3	1.2	—0.5
12.....	359.0	357.9	1.7	—1.1
13.....	553.0			

Note: Average absolute difference: 1.0 mm.

## ATTACHMENT A

(234) The required mathematical relationships are derived from the geometry of Figure 1.

$$\frac{W}{\sin (90^{\circ}-a-t)}=\frac{X}{\sin (90^{\circ}+a)}$$

$$\frac{X}{W}=\frac{\sin (90^{\circ}+a)}{\sin [90^{\circ}-(a+t)]}=\frac{\cos a}{\cos (a+t)}$$

$$X=\frac{W \cos a}{\cos a \cos t-\sin a \sin t}$$

$$\frac{W}{u}=\frac{x}{v}$$

$$X=\frac{ux \cos a}{v (\cos a \cos t-\sin a \sin t)}$$

$$\cos a=\frac{v}{(x^2+v^2)^{1/2}}$$

$$\sin a=\frac{x}{(x^2+v^2)^{1/2}}$$

$$X=\frac{ux}{(x^2+v^2)^{1/2}\left(\frac{v \cos t}{(x^2+v^2)^{1/2}}-\frac{x \sin t}{(x^2+v^2)^{1/2}}\right)}$$

$$X=\frac{ux}{v \cos t-x \sin t} \quad (\text{First equation of paragraph 207})$$

Given:

the axial image distance  $v$

rifle length, rear sight to the end tilted away  $X_1$

rifle length, rear sight to the end tilted toward  $X_2$

image length, rear sight to the end tilted away  $x_1$

image length, rear sight to the end tilted toward  $x_2$

$$X_1=\frac{ux_1}{v \cos t-x_1 \sin t}$$

$$X_2=\frac{ux_2}{v \cos t-x_2 \sin t}$$

$$\text{eliminate } u: \frac{X_1}{x_1} (v \cos t-x_1 \sin t)=\frac{X_2}{x_2} (v \cos t-x_2 \sin t)$$

$$\frac{X_1}{x_1} v \cos t-X_1 \sin t=\frac{X_2}{x_2} v \cos t-X_2 \sin t$$

$$(X_2 - X_1) \sin t = \left( \frac{X_2}{x_2} - \frac{X_1}{x_1} \right) v \cos t$$

$$\tan t = \left( \frac{X_2}{x_2} - \frac{X_1}{x_1} \right) \frac{v}{X_2 - X_1} \quad (\text{Equation in paragraph 208})$$

$$X_1 = \frac{ux_1}{v \cos t - x_1 \sin t}$$

$$u = \frac{X_1}{x_1} (v \cos t - x_1 \sin t) \quad (\text{Equation in paragraph 211})$$

The equation in paragraph 205 and the second equation in paragraph 207 are well known in elementary optics.

## ATTACHMENT B

No. 009215.

(235)

U.S. DEPARTMENT OF THE INTERIOR,  
GEOLOGICAL SURVEY,  
*Reston, Va., May 5, 1978.*

### REPORT OF CALIBRATION OF 2¼ X 2¼ CAMERA

Camera type 620 Imperial Reflex.

Lens type DUO.

Nominal focal length 77 mm.

Camera : Commission.

Identification : Exhibit No. 750.

Maximum aperture f/12.5\*.

Test aperture f/12.5.

SUBMITTED BY SELECT COMMITTEE ON ASSASSINATIONS, U.S. HOUSE OF REPRESENTATIVES

Reference : Letter dated March 2, 1978 from Mr. Michael Goldsmith.

These measurements were made on Kodak Verichrome Pan film type 620, developed in D-19 at 68°F for 3 minutes with continuous agitation. This film was exposed on a multicollimator camera calibrator using a white light source rated at approximately 3500K.

I. *Equivalent Focal Length* : 77.55 mm.

This measurement is considered accurate within 0.02 mm.

### II.—RADIAL DISTORTION

Field angle (degrees)	D <sub>o</sub> for azimuth angle				
	D <sub>o</sub>	0	90	180	270
5	0	61	-25	-44	7
5	388	611	331	260	350
2.5	1,706			1,646	1,767

\*This is a nominal value as the shutter is not equipped with either a T (Time) or B (Bulb) setting for holding the aperture in the open position.



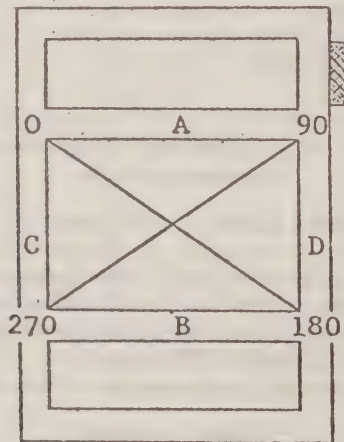
The radial distortion is measured for each of 4 radii of the focal plane separated by  $90^\circ$  in azimuth.  $\overline{D}_c$  is the average distortion for a given field angle. Values of distortion  $D_c$  are based on the equivalent focal length referred to the field angle co-tangent for  $7.5^\circ$ . The radial distortion is given in micrometers and indicates the radial displacement of the image from its distortion free position. A positive value indicates a displacement away from the center of the field. These measurements are considered accurate within  $10\ \mu\text{m}$ . It is clear from these variations in the values reported among the four radii from the average that a substantial amount of asymmetric distortion is present in this lens.

### III.—RESOLVING POWER IN CYCLES/mm

Field angle	$0^\circ$	$7.5^\circ$	$15^\circ$	$22.5^\circ$
Radial lines.....	14	16	20	-----
Tangential lines.....	20	20	10	-----

The resolving power is obtained by photographing a series of test bars and examining the resulting image with appropriate magnification to find the spatial frequency of the finest pattern in which the bars can be counted with reasonable confidence. The series of patterns has spatial frequencies from 10 to 223 cycles/mm in a geometric series having a ratio of the 4th root of 2. Radial lines are parallel to a radius from the center of the field, and tangential lines are perpendicular to a radius.

### IV. Indicated Principal Point



Positions of all points are referenced to the indicated principal point as origin. The diagram indicates the orientation of the referenced points when the camera is viewed from the back. The direction of film travel is to the top.

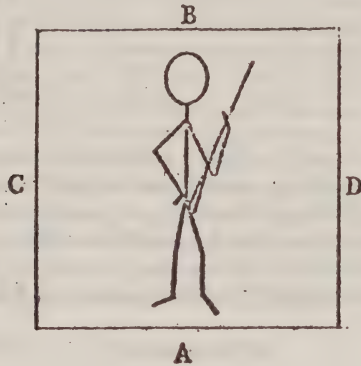
Indicated principal point to midsides of focal frame :

A	-----	Unable to measure.
B	-----	28.79 mm.
C	-----	27.96 mm.
D	-----	29.34 mm.

These measurements were made from a shadow image formed in the focal plane. The method of measuring these distances is considered accurate within 0.01 mm.

The camera was alined for calibration by autocollimating on the mounting surface where the front of the test camera-lens was placed for the film exposures. It is evident, however, that this is an indirect procedure, but the only method possible for a camera of this type. This alinement process made the front of the lens ring normal to the axis of the collimator beam emergent from the  $0^\circ$  collimator.

#### V. Camera Negative



The diagram indicates the orientation, with emulsion-up of a negative submitted for focal frame measurements.

Distances between midsides:

A-B	-----	57.10 mm.
C-D	-----	57.14 mm.

The method of measuring these distances is considered accurate within 0.01 mm.

WILLIAM P. TAYMAN,  
*Branch of Research and Design,*  
*Topographic Division.*

#### ATTACHMENT C

##### ALYEA FILM STUDY

(By C. S. McCamy)

(236) After the President was shot, the Dallas police searched the Texas School Book Depository and found a rifle. While the search was in progress, a motion picture was being made by T. Alyea of Dallas television station WFAA. I studied a 16-mm copy of that motion picture film. I did not find a satisfactory single frame displaying the entire length of the rifle. The frame selected for analysis was about 55 feet into the film. It depicts a man displaying the rifle in the book depository. The frame may be identified by a prominent lint mark on the film that is located on the image of the man's shoulder. Measure-

ments to the nearest 0.0001 inch were made on the film by means of a Nikon measuring microscope. The computed constants were: tilt angle  $t = 23.1^\circ$  with the muzzle tilted away from the camera, object distance  $u = 2511$  mm, and image distance  $v = 25.66$  mm. The measured and computed distances were as follows:

Part of rifle	Image (mm)	Rifle computed (mm)	Rifle in archives (mm)
Muzzle.....	2.50	277.5	277.4
Front of front sight.....	2.30	254.4	253.9
Rear of front sight.....	2.19	241.8	242.6
Bayonet mount.....	1.71	187.2	184.6
Mount ring.....			167.5
Stock clamp.....	1.31	142.5	141.3
Front of stock band.....	0	0	0
Rear of rear sight.....	-1.88	-193.9	-188.4
Front of trigger guard.....	-2.58	-263.2	-254.8
Front of trigger.....	-4.03	-401.8	-401.7

The conformity is well within the errors that might reasonably be expected when measuring such a small film. The very large deviation with respect to the front of the trigger guard should not be regarded as very significant because that piece of the rifle curves around to meet the line of the forestock in such a way that it is difficult to see or set a hairline on where it ends. The bolt, comb, and butt were not visible in this frame.

#### ATTACHMENT D

##### RANDOM PATTERN ON OSWALD RIFLE

(Sgt. Cecil Kirk)

(237) As a piece of equipment is utilized, either properly or abused, one can expect that the utilization or abuse will leave individual artifacts or damage on that equipment that, when evaluated together, will be found to be unique to that piece of equipment. For example, an automobile that is 2 or 3 years old provides a classic example of random patterning. The nicks and dents on the doors and sides of the vehicle are mostly caused by the doors of other cars being pushed against it in parking lots. Because the car is parked in several locations adjacent to many cars of differing sizes, a pattern of abuse will develop on the vehicle. As that vehicle is driven, it will occasionally be struck by stones and other roadway debris that add additional nicks and dents to the surface of the vehicle. Minor damage caused by insignificant accidents will add other identifiers to the random pattern which in turn will make it even more unique. These are the elements that make up the pattern of artifacts caused by utilization of the vehicle.

(238) A military rifle will also establish a random pattern on its surface. After the weapon is disposed of by the military and is sold, stored, and resold as a civilian sporting weapon it will receive other elements of its individual pattern of damage. The Mannlicher-Carcano rifle in this case displays its own pattern of identifiers—its pattern of damage. Of the numerous artifacts on this particular weapon—one mark or pattern of abuse is very distinctive. It is a rather large gouge in the forestock of the weapon. It has a measurable shape, and, because



of its depth, photographs of the rifle reflect the gouge in a manner not unlike a crater on the moon, a tire impression on a muddy road, or a tool mark in soft metal.

(239) In the Lee Harvey Oswald backyard photographs identified as 133A Stovall, 133A de Mohrenschildt, and CE-134, that same gouge is quite visible and can be measured and compared with the gouge on the questioned rifle. They are identical in every respect.

(240) Based upon this system of identification, the rifle in these photographs can be positively identified as the same rifle that is presently in the custody of the National Archives. Finally, it should be noted that although an FBI expert declined to make a positive identification of the rifle in question based upon this gouge mark, this expert did not have access to all of the same quality photographic prints that were available to the Panel. For example, the 133A de Mohrenschildt and 133A Stovall prints, both of which are of high quality, were obtained and reviewed by the committee in 1977 and 1978 respectively. This was the first time that these materials were analyzed. In addition, positive identification of the rifle was based upon an examination of CE-134, a very good enlargement (from the original negative) of CE-133A.\* The FBI's expert in 1964, however, apparently did not consider this photograph in reaching his conclusion.

#### B. Alleged Alibi Evidence—The Billy Lovelady Issue

[See pars. 759-70 *infra*.]

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\*Ibid.

## IV. CONSPIRACY QUESTIONS

### A. *Alleged Gunmen in Dealey Plaza\**

#### 1. INTRODUCTION

(241) A number of commentators and critics of the Warren Commission have asserted that photographic evidence exists which demonstrates that more than one gunman was present in Dealey Plaza. (79) The evidence includes an assortment of still- and motion-picture photography taken by the amateur and professional photographers present in the Plaza that day. If these films and pictures were ideal in quality, the questions they have raised might have been answered long ago. Nevertheless, there are limitations inherent in any photographic image,\*\* and many of the issues concerning the number of gunmen in Dealey Plaza have arisen from interpretation of details that approach these inherent limitations. In some, the quality is too poor to allow an unambiguous interpretation of the images, resulting in differences of opinion.

(242) Because of the advances that have been made in the photographic sciences associated with image enhancement, (80) an effort was made to resolve the issues raised in photographs of the assassination by applying modern technology. It was understood, however, that because of inherent limitations to this technology not all image enhancement attempts would necessarily be successful and that, even when successful, the clarification obtained might not be sufficient to answer the questions that have been raised. (81)

#### 2. ISSUE

(243) Is there any photographic evidence of a gunman or gunmen in Dealey Plaza at the time of the President's assassination?

#### 3. MATERIALS AND PROCEDURES

(244) The available photographic materials were reviewed by the Panel and contractors. Those considered most relevant to the question of gunmen in Dealey Plaza (e.g., materials alleged to show a gunman, weapon, flash of light, puff of smoke) were selected for image

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\*This section was prepared under the direction of Bob R. Hunt, with the assistance of Harry Andrews, Robert Chiralo, Donald Janney, and Charles Leontis. For related public hearing testimony of Hunt, September 25, 1978. See HSCA-JFK Hearings, vol. IV, pp. 387, 420.

\*\*The limitations inherent to photography can be classified as optical and photochemical, the former referring to the optical components which form an image, the latter to the processes which capture and permanently record the image. See J. C. Dainty and R. Shaw, *supra* note 2.

enhancement, provided that they were judged to have sufficient potential for meaningful improvement.<sup>1</sup>

245) Based upon this review, the following photographic materials were selected for image enhancement.<sup>2</sup>

Dillard—35 millimeter black and white transparencies.

Powell—35 millimeter color transparency.

Hughes—8 millimeter color-motion-picture film.

Willis—35 millimeter color transparency.

Moorman—Polaroid print.

Zapruder—8 millimeter color-motion-picture film.

Nix—8 millimeter color-motion-picture film.

246) Three different categories of image enhancement technology were available to the Panel: Photo-optical/photo-chemical, digital image processing, and autoradiography.<sup>3</sup> The selection of a particular technology depended upon the nature of the photograph and the type of clarification considered necessary.

#### 4. CONCLUSIONS

247) *a.* Evidence of changes in the open sixth-floor window of the Texas School Book Depository is visible. The changes are of two types:

248) (1) There is an apparent rearranging of boxes within 2 minutes after the last shot was fired at President Kennedy;

249) (2) There is an appearance or impression of motion in the open sixth-floor window a few seconds prior to the assassination. While the pattern of motion is not necessarily inconsistent with movement by a human being, it was nevertheless considered probably to be photographic artifacts.

250) *b.* There is no visible evidence of anyone at the closed windows adjacent to the open sixth-floor window of the Texas School Book Depository. Motion in these windows was also attributed to photographic artifact.

251) *c.* There is no definitive visible evidence of any gunmen in the streets, sidewalks, or areas adjacent to Dealey Plaza. Nor was any evidence discerned of a flash of light or puff of smoke.

#### 5. ANALYSIS

252) The following section describes the processing and analysis of the Dealey Plaza photographic evidence undertaken by the Photographic Evidence Panel. Each of the major subdivisions of this section contains a synopsis of the issues in question, a summary of the relevant photographic evidence, and a discussion of the special processing operations used to enhance the evidence. The evidence in question is identified by using the photographer's name—for example, a motion picture taken by Orville Nix will be referred to as the Nix film. In the

<sup>1</sup> In general, a minimum requirement was that the material be original and transparent film. See pars. 39–41, *supra*.

<sup>2</sup> A list of the most important photographic materials reviewed by the Panel is set forth in par. 42, *supra*.

<sup>3</sup> See pars. 9–38, *supra*.



case of multiple pictures by the same photographer, frame numbers are also used.\*

(a) *The Texas School Book Depository*

(253) Evidence from sources other than phototgraphy led the Warren Commission to conclude that the shots that struck the President had come from an open window on the sixth floor of the Texas School Book Depository. (82) Several sources of photography exist that show the window before and after the fatal shots. These were examined for evidence of a gunman.

(254) The following photographs of the Texas School Book Depository were subjected to image enhancement :

- (1) The Dillard photographs (2).
- (2) The Powell photograph.
- (3) The Hughes motion-picture film.

(255) The Dillard and Powell photographs and Hughes film were taken from the region of the intersection of Houston and Elm Streets in Dealey Plaza. Dillard, a professional photographer, was riding in a press car in the Presidential motorcade. At the time he took his pictures of the Depository, the car was approaching Elm and Houston. (83) Powell was standing considerably to the right of Dillard, near the southeast corner at Elm and Houston, and his picture therefore shows the window from a much more oblique angle. (84) Hughes was standing near the southwest corner of Houston and Main Streets; (85) thus, his motion picture film was taken from a much greater distance than the Dillard and Powell photographs.

(256) The time at which the photographs of Dillard and Powell were taken is only approximate. Dillard stated that his second picture was taken a few seconds after the last shot that he heard. (86) Powell has estimated that he took his picture about 30 seconds after the last shot. (87) A shadow analysis performed by the panel confirmed that these photographs were taken at the same approximate time, with Dillard's first and Powell's second. (88) The Hughes film ended 2 to 10 seconds before any shots were fired, as indicated by the position of the Presidential limousine in the film.\*\*

1. DILLARD AND POWELL PHOTOGRAPHS

(257) Examination of both the Dillard and Powell photographs of the sixth floor windows shows an open window with deep shadows in the region behind it. The deep shadows indicate the film was underexposed in these regions; that is, too little light reached the film for a clear recording of any details in the room behind the window.

(258) A number of enhancement processes were applied to the photographs in order to bring out any details obscured within the underexposed regions. They were as follows:

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\*This system has been used by others who have analyzed the evidence, including the Warren Commission and the commentators and critics of the Warren Commission.

\*\*The panel did not consider it necessary to refine these estimates of the time of the taking of the photographs because it would not have helped to resolve the issue of whether these photographs depicted any gunmen.

- 259) (1) Photographic enhancement (using photo-optical and photochemical techniques) of the underexposed regions of the Dillard photograph undertaken at the Rochester Institute of Technology (RIT). (89)
- 260) (2) Autoradiographic enhancement of the underexposed regions of the Dillard photograph at Stanford Research Institute, Inc. (SRI). (90)
- 261) (3) Computer enhancement of the underexposed regions of the Dillard photograph at the University of Southern California and the Aeronautical Corp. (91)
- 262) In addition, the Dillard photographs were scanned and digitized for possible computer enhancement. Nevertheless, no such enhancement was performed because the Panel decided that the autoradiographic technique had more potential for success.
- 263) The photographic and computer processes made visible details that had been obscured in the underexposed regions of the photographs. Both the photographic enhancement by RIT and the autoradiographic enhancement by SRI revealed a feature in the fifth floor window immediately beneath the sixth floor window. Figure IV-1 (JFK exhibit F-153) shows one of the original Dillard photographs, and figure IV-2 is an autoradiographic enhancement. The detail revealed by the processing appears to be a circular light fixture hanging from the ceiling of the fifth floor room, with a light bulb in the center of the fixture.\*

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\*The Panel observed all enhanced images under optimum viewing conditions. The reproduction of the enhanced images for this report results in a degradation in quality. The Panel's decisions were reached on the basis of the image quality of the original enhanced photographs, and not on the quality of images as reproduced in this report. See par. 28 supra.

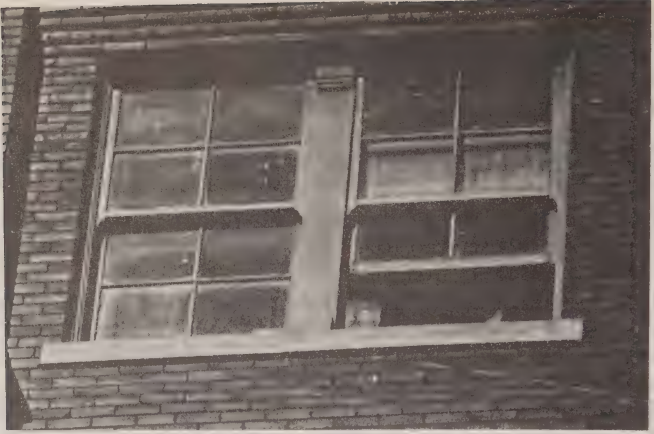


FIGURE IV-1.—Dillard photograph (unenhanced).



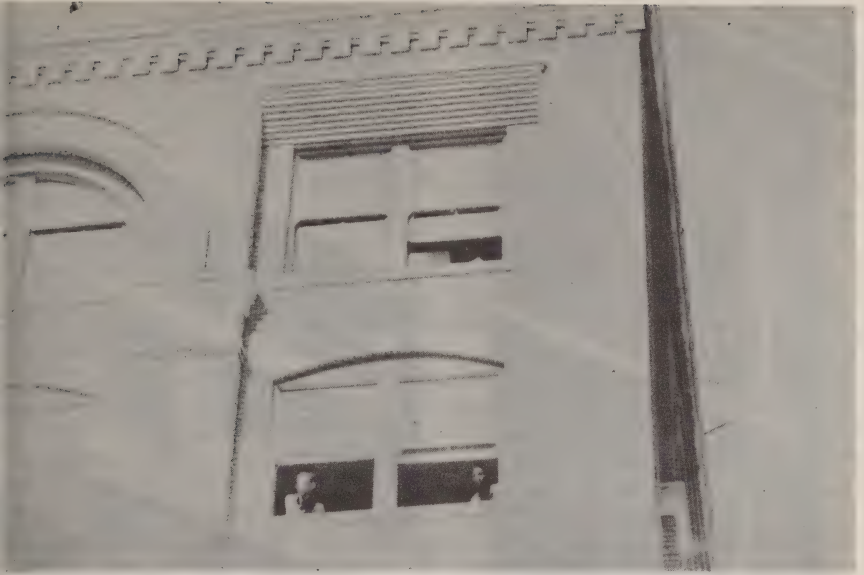


FIGURE IV-2.—Autoradiographic enhancement—Dillard photograph.

(264) In the enhanced Powell photograph additional details became visible on the boxes in the windows. (See figure IV-3, JFK exhibit F-157.) Nevertheless, in neither photograph did the processing operations reveal any sign of a human face or form in the open sixth floor or adjoining windows.



FIGURE IV-3.—Powell photograph. Top: Enhanced window area. Bottom: Unenhanced original.

265) The Panel concluded that the light fixture revealed in the fifth floor window served as a "benchmark" against which the sixth floor enhancement could be judged. Accordingly, the enhancement of a recognizable object in the fifth floor window gave the Panel confidence in its judgment there were no recognizable human forms in the enhancement of the sixth floor windows.

266) Although human faces or forms were not visible in the enhanced photographs, inspection of figures IV-2 and IV-3 reveals a difference in the boxes visible through the sixth floor window. In the Dillard photograph, only two boxes are immediately visible, one each at the left and right of the window frame. Nevertheless, the Powell photograph shows several additional boxes. There are two possible explanations for this difference:

267) (1) The Powell photograph may reflect only an apparent change in the boxes; the different angle from which Powell viewed the depository may have caused a different set of boxes within the room to be framed within the window;

268) (2) The boxes were moved during the time that elapsed between the Dillard and Powell photographs.

269) Since the precise positions of Dillard and Powell at the time of the photographs were unknown, it was not possible to calculate precisely the region within the sixth floor room that would have been visible to each photographer. In the Dillard photograph, the two boxes at the left and right of the window frame appear to be in the full light of the Sun, with no shadows cast on them by the frame of the partially opened window. In the Powell photograph, it also appears that the boxes are in full sunlight, with no shadow cast on them by the window frame.

270) A simple trigonometric calculation shows that the two boxes at the left and right lie approximately 6 inches from the plane of the window (see addendum A). If full sunlight is falling on the additional boxes in question in the Powell photograph, they must also lie close to the plane of the window.\* For this reason, the Panel concluded that the additional boxes visible in the Powell photograph were moved during the interval between the Dillard and Powell photographs.

271) An additional issue relating to the sixth floor windows was the possible presence of a human face or form in the adjacent windows. None was found by the Panel.

## 2. HUGHES MOTION PICTURE FILM

272) The Hughes film shows the Presidential limousine for a total of 88 frames as it is proceeding down Houston Street toward the Texas School Book Depository. The open sixth floor window of the depository is visible in the upper left corner of the film frames. An object, approximately rectangular in shape, is visible in the open

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\*If the additional boxes in the Powell photograph were so far back into the room that the difference in viewing angle made them apparent in the Powell photograph and not in Dillard's, then they would not appear to be in full sunlight. Since at the time of the assassination it was late fall, the midday sun was south of directly overhead and therefore would have been entering those windows of the Texas School Book Depository facing directly south.



window. When the film is viewed as a motion picture, the object distinctly appears to be moving.

(273) The 88 frames were processed for computer enhancement and motion analysis at the Aerospace Corp. (92) The scans were centered on the portion of the frames that showed the open sixth floor window and the closed windows adjacent to it. After scanning, the images were viewed on a precision television soft-copy video-display computer system that was used to adjust the contrast of the displayed images.

(274) Figure IV-4 (JFK exhibit F-121) shows a single unenhanced frame of the Hughes film. It was the judgment of the Panel that the object in the open window was partially in the Sun and partially in the shadows. This judgment is based upon the enhancement of selected frames of the Hughes film by computer contrast alteration.

(275) As the contrast of any single frame was changed by computer, the shape of the object in the open sixth floor window also changed. When an object is in both Sun and shadow and an exposure is chosen that will record the sunlit features, the shadowed features will be underexposed. A computer can be used to alter the contrast and correct for the underexposure so that the object within the shadows is more directly visible. In this case, however, the processing also changes the shape of the image.



FIGURE IV-4.—Hughes film (unenhanced) Top: Full frame view. Bottom: Enlarged window area.

276) It was theorized that the contrast of each frame of the unenhanced Hughes film was not constant in the region of the sixth floor window, and that this was causing an apparent change of shape that appeared to be motion in the film sequence. The panel used computer displays to inspect the 88 frames of the Hughes film without enhancement and computer calculations to measure the contrast. Both the vis-

ual inspections and contrast measurements established that the contrast of the sixth floor window images was changing from frame to frame.

(277) Inspection of each frame of the Hughes film revealed other photographic anomalies. The sixth floor window of the depository is near the edge of the film frame, and consequently it is less in focus than objects near the center of the image. Objects at the edge of a film frame were also less bright than objects at the center (a phenomenon called "vignetting"). Further, as film moved through the camera, it may not have been resting at the exact point of focus, resulting in an image that was slightly out of focus. The panel judged that one or more of these effects were present in the frames of the Hughes film and that they, too, could lead to a perception of motion when the film is viewed as a motion picture.

(278) The Aerospace Corp. used computer processing to reduce these effects as much as possible. First, common points in all 88 frames were "registered" in the computer so that each frame possessed the same coordinates in the computer. Next, the photographic contrast was adjusted to be as equal as possible between all frames. This was done by picking a bright point that was the same in each frame (the white edge of the windowsill was picked), and a dark point that was the same in each frame (a region in the window, away from the region of apparent motion, was picked). Each frame was then manipulated by computer so that all the bright and dark regions were the same for all frames.

(279) This equalization of contrast caused much of the apparent motion to disappear. In the computer-processed images, most of the motion perceived in the original film was not visible. Since some changes in focus were still visible, this anomaly was corrected by slightly altering the physical dimensions of those images that were most out of focus.

(280) The computer processing eliminated much, but not all, of the perceived changes. The extent of the remaining changes was quantified by using the computer image display at the Aerospace Corp. The operator of a computer display can position a computer-generated dot on the video screen; the computer can then read the coordinates of the dot onto the screen. In this case, the dot was placed by the operator at a position that was judged to be the center of the object in the open sixth floor window. For each frame, the computer then read and recorded the coordinates of this dot. To minimize human statistical error in positioning the dot, identification of the center of the object was repeated several times for each frame and the results were averaged. Finally, the computer calculated the change in the position of the center of the object from frame to frame.

(281) The results of this motion analysis can be seen in figures IV-5-6 (JFK exhibits F-159 and 159-A). Figure IV-6 shows the center of the object as determined by the motion of the dot. Each arrowhead position on the exhibit indicates the location of the center of the object for the particular frame number designated. The direction of the motion between frames can be discerned by going from each arrowhead to the next sequentially numbered arrowhead. The length of each arrow is proportional to the actual distance the center of the



object moved between frame identifications, and the thickness of each line is proportional to the amount of time (indicated by the decimal number) that it took to move that distance. Figure IV-5 shows the actual change in the shape of the object for frames 55, 56, 59, and 61.

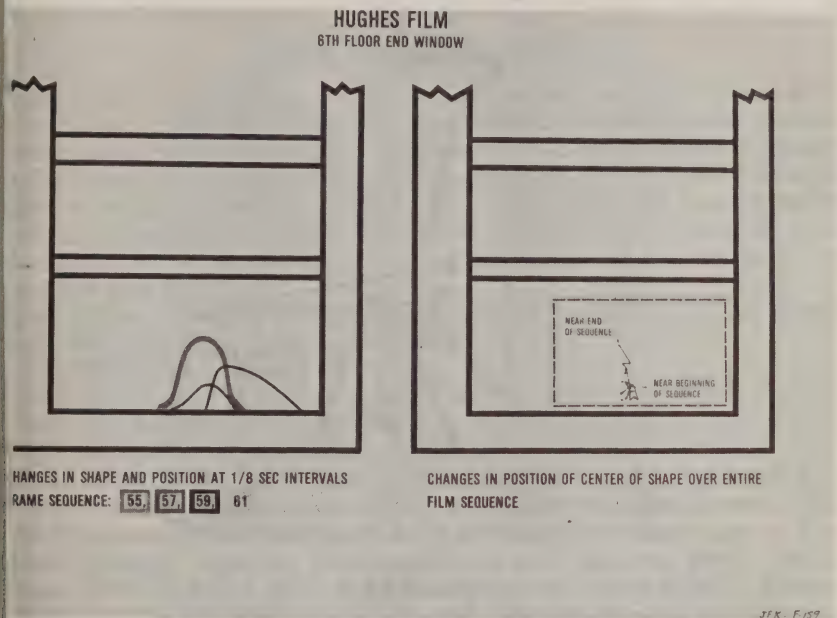


FIGURE IV-5.—Hughes Motion Analysis Diagram.

- 82) The Panel interpreted these exhibits as demonstrating that the perceived motion was apparent rather than real. This conclusion was based on the following considerations:
- 83) (1) The pattern of motion does not display a consistent direction, but appears to be attributable either to random motions or to purposeful, consistent motion of a very complex type;
- 84) (2) When the time interval between positions is considered, the motions appear to be quite rapid. For example, motions of 18 inches per second can be calculated. While such rapid motions are not impossible, they are considered improbable when considered along with the complexity of the motion as revealed in figure IV-6.



FIGURE IV-6.

(285) (3) In one two-frame sequence, the object disappeared: It is present in frame 59, but not in frame 60, and then is visible again in frame 61. This abrupt disappearance and reappearance is not consistent with human motion and can be explained only as a photographic anomaly.

(286) In summary, a pattern of changes in the object in the sixth floor window is visible in the computer processed images of the Hughes film. Nevertheless, the Panel did not attribute this pattern of change to the motion of any recognizable object such as a person. While the overall pattern of changes is not necessarily inconsistent with human motion, the Panel still concludes that the perceived motions are attributable to photographic artifact.

(287) The closed sixth floor windows adjacent to the open sixth floor window were also examined. The same type of artifacts were present.

#### BRONSON MOTION PICTURE FILM

(288) The original 8 millimeter movie film of the Texas School Book Depository taken by Charles L. Bronson a few minutes before the assassination was not made available to the committee until December 2, 1978. At that time, it was reviewed by several of the committee's photographic contractors and members of the Photographic Evidence Panel. Based upon this preliminary review, the scientists believe that, as in the Hughes film, the apparent motion in the sixth floor southeast corner windows seems to be random and therefore is not likely to have been caused by humans. Nevertheless, no firm conclusion could be

eached without applying digital image processing, which was not possible because of time and money constraints. The Panel suggests that the good quality of this film makes it advisable that image enhancement be considered (possibly by the Department of Justice) if further investigative efforts are undertaken. (93)

(b) *The grassy knoll*

289) To the right of the Presidential limousine as it proceeded down Elm Street in Dealey Plaza is a small knoll. An assortment of trees, bushes, and concrete works is located on it. Several persons present in the plaza at the time of the assassination stated that they thought shots were fired from the region of this knoll, (94) and commentators and critics of the Warren Commission have asserted that there is photographic evidence that supports the claims of a gunman firing from the area (95).

290) The following photographic evidence pertaining to the grassy knoll was subjected to enhancement:

- (1) Willis No. 5 photograph;
- (2) Moorman No. 2 photograph;
- (3) Nix motion picture film; and
- (4) Zapruder motion picture film.

291) The Willis No. 5 photograph was taken from the south side of Elm Street, near the intersection of Houston and Elm Streets. (96) The Moorman picture was taken from a point on the south curb of Elm Street, midway between Houston Street and the exit from Dealey Plaza. (97) The Nix film was taken from the other side of Dealey Plaza near the intersection of Main and Houston Streets. (98) Zapruder was standing on a concrete abutment by the retaining wall in the grassy knoll area (99).

292) The Zapruder and Nix films span an interval that includes the fatal shot to the head, and therefore no ambiguity as to the time they were taken exists. The time at which the Willis and Moorman photographs were taken is, however, difficult to establish. From the position of the President and Mrs. Kennedy in the limousine in the Moorman photograph, the Panel believes that the photograph was taken at the time of the fatal head shot, corresponding with frame 313 of the Zapruder film.\* The Willis photograph appears to have been taken several seconds earlier, at approximately Zapruder frame 202.

#### 1. THE WILLIS PHOTOGRAPH

293) Preliminary visual inspection of the Willis photograph showed extensive blurring of all features of the picture near the retaining wall on top of the grassy knoll. The blurring is most clearly seen in the freeway sign, which is in the line of sight between the retaining wall and the Willis camera. (See fig. IV-7, JFK exhibit 155.) It was caused by motion that was complex and not uniform over the entire image. The Panel judged that the motion was probably a combination of rotation about a point to the lower left of the optical axis, and that a component of linear translation (that is, motion in a straight line) in the motion was also possible.

\*Zapruder frame numbers are used as the basic time references because this film spans the most comprehensive interval of time. See par. 146, *supra*.





FIGURE IV-7.—Willis No. 5 photograph (unenhanced).

(294) The Willis photograph was scanned for possible input into a computer. Since it is in color, the scan had to be a full-color scan. The knoll area from the scan was presented on a full-color computer video display. The display and manipulation were performed at the University of Southern California. (100)

(295) The retaining wall at the top of the knoll was subsequently enlarged by a computer operation similar to enlargement by photo-optical and photo-chemical techniques. This computer display made visible an object whose size and shape were consistent with a human being, positioned just inside the retaining wall. (See fig. IV-8, JFK exhibit F-160.) The object possessed colors with a distinct resemblance to flesh tones, as revealed on the color display. The Panel perceived the object to be that of a badly blurred image of a person dressed in dark clothing, standing or leaning just inside the retaining wall.



FIGURE IV-8.—Willis No. 5. Wall Image Enhancement.

(296) Since the image was badly blurred, an attempt was made to use the computer to remove the blur. Blur removal can be accomplished if its extent is not too great. (101) Unfortunately, the image was so severely degraded in the region of the retaining wall that deblurring efforts were not successful.

(297) The next computer processing step was to make measurements of the color values of the object behind the retaining wall in order to compare the perceived flesh tones with those of a person at another location in the Willis photograph. The photograph was scanned in color: Separate measurements were made of the three primary colors, red, green and blue, from which other colors can be made.

(298) After scanning, an image analyst at the Aerospace Corp. viewed the image on a color video image display and positioned a computer-generated dot at those points where colors were to be measured. The computer then recorded the red, green, and blue values in the image at the dot's positions. A similar analysis was carried out at the University of Southern California.

(299) Regions measured at the Aerospace Corp. included the flesh tones of the object near the retaining wall and of Marilyn Sitzman, the secretary to Abraham Zapruder, who is visible in the Willis photograph. Sitzman's flesh tones were measured both in shadow and sunlight. At the University of Southern California, flesh tones were measured for the object at the retaining wall and for several people: A policeman, a bystander, and a child. In addition, measurements were made of Mrs. Kennedy's hat, which was pink in color and had a flesh tone appearance on the video display. (102)

(300) The Aerospace Corp. measurements showed the flesh tones of the object near the retaining wall to be comparable to the known flesh tones of Zapruder's secretary. USC's measurements also showed similarity between the flesh tones of the object and those of known persons; however, the similarities were not as strong as those found by Aerospace. The measurements of Mrs. Kennedy's hat were found to be distinguishable from the measurements of known flesh. Nevertheless, the differences of Mrs. Kennedy's hat from known flesh measurements were only marginally greater than differences of flesh tone measurements from each other. (103)

(301) Based on these measurements, as well as visual analysis, the Panel concludes that the object was most probably an adult person standing behind the wall. First, the general shape and structure of the object, including the location of the flesh tones, appear to be human. Second, the height of the object in relation to the known height of the wall is consistent with that of an adult of average height (5'6" to 6' tall). Third, the measured values of the flesh tones of the object are comparable with those of people in the photograph. Fourth, an additional Willis photograph, No. 6, taken after the Presidential limousine had exited Dealey Plaza but showing approximately the same field of view as No. 5, no longer shows the object near the retaining wall, or anywhere else; it has disappeared. (See fig. IV-9.) The mobility of the object greatly increases the likelihood of its being a person.



FIGURE IV-9.—Willis No. 6 photograph.





FIGURE IV-10.—(JFK exhibit F-129) Moorman No. 2 photograph.

(302) Since the panel concluded that the object was probably a person, the next question was whether there was any evidence of a weapon associated with this individual. Visible near the region of the hands is a very distinct straight-line feature extending from lower right to upper left. The panel notes, however, that the image is badly blurred in this region and that the direction of the blurring is the same as the southeast-northwest orientation of the linear feature near the hands. The blur would stretch any small point object on the wall into a linear object. As the blur could not be clarified, the panel could reach no conclusion as to the existence of a rifle or any other weapon in relation to the person standing behind the retaining wall.

## 2. THE MOORMAN PHOTOGRAPH

(303) The Moorman No. 2 photograph is a black and white Polaroid print that has suffered from handling during the intervening years. A number of large and small defects were visible on the photograph when the panel examined it. It, too, shows the grassy knoll and the retaining wall in the same region where the person was identified in Willis No. 5. (See fig. IV-10, JFK exhibit F-129.) It also shows another region of the knoll which critics of the Warren Commission have identified as important: The stockade fence. This fence runs toward the railroad overpass from the region of the retaining wall. Various critics have claimed that gunfire was directed at the President from behind the fence. (104) Finally, this is the area from which the committee's acoustics analysis indicates a shot originated. (105)

(304) Since the Moorman photograph is opaque rather than a negative transparency, a conventional image scanner (one designed for transparencies) could not be used to sample it for computer input. Given its condition, the Panel judged that there was little merit to using computer processing. Instead, to enhance the quality of the image, a high-quality negative copy was made at the Rochester Institute of Technology. A series of photo enlargements was made from this negative. The contrast and brightness were altered in these to bring out any objects or details that might be visible in the shadows or underexposed regions. (106) These photographic enhancements were focused on the region of the retaining wall.

(305) These efforts were not successful. The Moorman photograph was so underexposed in the region of the retaining wall that the alterations in contrast produced no significant increase in detail. The Panel could find no evidence of a person in a position on the retaining wall corresponding to that identified in the Willis No. 5 photograph.

(306) The Panel did not carry out any enhancement work on the Moorman photograph in the area of the stockade fence because this area was judged to be of even lesser quality than the retaining wall area, which had yielded negative results. This decision, however, as well as the decision not to apply digital image processing to this item, was made long before the committee's acoustics analysis was finalized. Although it is extremely unlikely that further enhancement of any kind would be successful, this particular photograph should be re-examined, in light of the findings of the acoustics analysis.

### 3. THE NIX FILM

(307) The final photographic source relating to the grassy knoll retaining wall is the Nix motion picture film. Several frames coinciding with the fatal head shot frames of the Zapruder film were selected for scanning and input into the computer. The scanning was performed at the Los Alamos Scientific Laboratory; the scanned data was then sent to the Aerospace Corp. for enhancement by computer. The mode of enhancement was an edge and detail sharpening process that has the effect of making the photograph appear more in focus. (107) Fig. IV-11 (JFK exhibit F-161) shows both original and enhanced images of the Nix film, centered around the region of the retaining wall.



FIGURE IV-11.—Retaining wall image (Nix film) Top: Enhanced. Bottom: Unenhanced.

(308) The enhanced Nix film shows an object that can be construed as having a shape similar to that of a person. It is also possible to interpret this object as being of the same general shape as the person identified at the wall in the Willis No. 5 photograph. Nevertheless, the person in the Willis photograph displayed distinct flesh tones in the computer display of the image. No such pattern of flesh tones is visible in the enhanced (or original) Nix frames.



(309) The Panel could not conclude that the object near the retaining wall in the Nix film was the same as the person visible in the Willis No. 5 photograph. This image was not identified by the Panel as a human being. It was more likely the result of a pattern of light and shadows cast on an object in the background behind the retaining wall by the nearby trees.

(310) The area of the retaining wall image in the Nix frames was also examined for the presence of a flash of light or a puff of smoke from a discharging rifle, which some bystanders claimed to have seen. No evidence of either was found.

(311) The Panel also examined another controversial aspect of the Nix film. As Nix panned his camera from right to left following the motion of the Presidential limousine, the background of the grassy knoll came into view. In it, beyond the retaining wall and running along the crest of the knoll, is a region of deep shadow that is broken by patches of light. For a number of frames there appears to be a brightly lit object whose shape some have interpreted to be that of a man sighting a rifle toward the Presidential limousine. The right "arm" of this object is rigidly extended outward from the "body," with the left "arm" tucked in more tightly, as if supporting a rifle stock. There is, between and above these arms, a shape that looks like a "head." That object has been interpreted to be a rifleman in the classic military posture for firing a rifle. (108)

(312) Magnification of the classic gunman object showed it to be indistinct and blurry. It was decided to process these images by computer techniques that would bring the image more "into focus" by making its features sharper. Computer enhancement work was carried out at both the Aerospace Corp. and the Los Alamos Scientific Laboratory. (109)

(313) It was recognized that the limitation on improving the images would be the noise in the frames. Since several frames showed the region in question, it was decided to apply a "frame-averaging" technique. This process involves registering the frames and then adding them together to reduce noise, then enhancing the resulting product. This technique can greatly improve the quality of an enhancement. (110) Aerospace applied an enhancement process to the individual frames identical to the one applied to the Nix film for the person-at-the-retaining-wall image (see fig. IV-12, JFK exhibit F-163); (111) Los Alamos Scientific Laboratory applied a more sophisticated technique known as MAP restoration. (112)



FIGURE IV-12.—Classic gunman image (Nix film) Top: Unenhanced. Bottom: Enhanced.

(314) Figure IV-13 (JFK exhibit F-162) shows the original and enhanced version of one Nix frame as produced at the Los Alamos Scientific Laboratory; the original is shown at the top, the enhanced version at the bottom. A total of eight frames were registered, added and enhanced to produce the lower image. Eight frames, considered to have the least blur or noise, were selected.

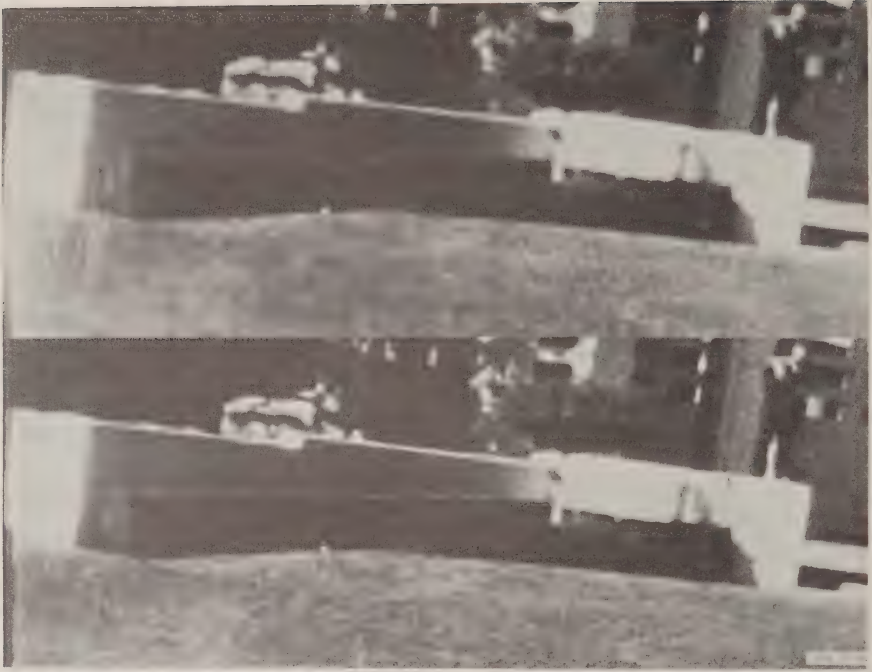


FIGURE IV-13.—Classic gunman image (Nix film) Top: Unenhanced. Bottom: Enhanced.

(315) After examining the enhanced image, the Panel concludes that the so-called classic gunman object was not a gunman. First, there is no evidence of human flesh tones in the “head” and “hands”; whereas the people in the Nix film have distinct flesh tones, the object here is almost uniformly white. Second, the white tones are identical in appearance with the white tones of the light regions of the shadow patterns cast on the wall of the structure behind the retaining wall by sunlight filtering through the nearby trees. Third, in the enhanced image, the shadow pattern above and to the right of the object is seen to be connected to the object itself.

(316) The Panel concludes that the most probable explanation is that the image is a chance pattern of sunlight on the structure behind the retaining wall. The Panel’s conclusion was strengthened by an observation at the Aerospace Corp. that in one frame the “right arm” of the object disappears, only to reappear in the next frame. Such behavior would be virtually impossible for a person, but is conceivable for tree branches casting a shadow pattern on a wall.

(317) The Panel also examined the classic gunman object for evidence of a flash of light or puff of smoke. To enhance any phenomena as transient as these, the frames were differenced, that is registered frames were subtracted from each other sequentially in time. This technique makes transient phenomena highly visible. (113) No evidence of any flash or smoke was found.

(318) The Panel also reviewed a previous report by the Itek Corp. (114) Itek measured the relative displacement of the classic gunman in successive frames of the Nix film as the camera panned



from right to left. The extent to which an object shifts in successive frames can be used to calculate the distance from camera to object by applying the basic principles of photogrammetry. Iték calculated the distance from the camera to the object in this way and found that the calculations placed the object very near shelter 3 of Pergola 2 in Dealey Plaza. (115) Further study by Iték of the ground elevation in relation to the retaining wall showed that a line of fire toward Dealey Plaza would require that a rifle near this structure be 9 feet above ground. Iték concluded that the classic gunman object was a pattern of light and shadow on shelter 3. The Panel agrees with these conclusions.

#### 4. ZAPRUDER FRAME 413—PHOTOGRAPHY OF ALLEGED HEAD IN THE BUSH

(319) When the Presidential limousine accelerated and pulled out of Dealey Plaza after the shooting, Zapruder continued to follow it with his camera. As the car passes him, going from left to right in front of him, a bush becomes visible in the lower right of the film frame, moving into the field of view from the right and traveling to the left as Zapruder panned the camera to the right. For a number of frames, an object that resembles a head is visible within the bush. In Zapruder frame 413 the object is very distinct and clear. Extending from the region of the head is a distinct linear feature. Critics have claimed that this linear feature is a rifle and that the head is of a gunman hiding behind the retaining wall and firing into Dealey Plaza. (116)

(320) The head in the bush is visible only in a few frames. From Zapruder's position on an abutment, which was connected to the retaining wall that lay to the right of the Presidential limousine (as it proceeded down Elm Street), his camera was the only one positioned so as to look through the bush and to the limousine in a geometry that shows the head, bush and limousine in the same line of sight. Zapruder frame 413, which shows the head object most clearly, was exposed approximately  $5\frac{1}{2}$  seconds after the fatal shot to the President's head at frame 313.\*

(321) Since the head-like object is visible for several frames coming in from the right and moving to the left as the camera pans right, the Panel concluded that the object was real and not a chance arrangement of leaves. In frame 413, the head appears to be wearing a hat, such as a tennis hat, with a pulled-down brim. The "hat" is not visible in any other frames, however, and the Panel concludes that the "hat-brim" in frame 413 was only a coincidental juxtaposition of leaves near the head.

(322) Frame 413 was scanned for input to a digital computer at the Los Alamos Scientific Laboratory. (117) After scanning, the image was presented on a color video image display. The Panel again concluded that the object was a head. Flesh tones were visible on the back of the neck and ears. A hairline at the back of the neck was distinct and visible. The hair appeared to be fair in color; the head was either close-cropped or balding.

(323) Having found the object to be a head, placement of the head and bush in relation to Zapruder became of great importance. Placing the bush was simple because the Nix film shows Zapruder and the bush

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\*The time elapsed is readily calculated based on the camera framing rate of 18.3 frames per second.

in a series of frames. By using photogrammetric techniques, the USGS was able to place the Presidential limousine at the time of frame 413.(118) A line of sight drawn between Zapruder and the Presidential limousine passes directly through the bush, as seen in the survey map of Dealey Plaza (see fig. II-10, JFK exhibit F-133).

(324) To determine where the head lies on the line between Zapruder and the Presidential limousine, computer enhancement of frame 413 was undertaken at the Los Alamos Scientific Laboratory. (119) The image was processed by a technique that is designed to bring details into focus, the same technique used on the classic gunman frames of the Nix film. The result of the processing is seen in figure IV-14 (JFK exhibit F-164), where the original and enhanced images are displayed. From the enhanced image, measurements could then be made to determine the head location.



FIGURE IV-14.—Head in bush image. (Zapruder 413) Top: Unenhanced. Bottom: Enhanced.

(325) Accordingly, this photograph was then studied photogrammetrically. A basic principle in optics states that the size of an image is inversely proportional to the distance of the object from the camera that created the image.(120) Using this principle, the distance of an object from a camera can be calculated by comparing the size of its image to the image size of a similar object at a known distance. The size of the image of the head in the bush was compared to the size of the image of a head in the Presidential limousine. A simple calculation can determine where the head in the bush was located on the line of sight between Zapruder and the limousine (see addendum B).

(326) The head of the Secret Service agent climbing into the Presidential limousine was used for the calculation. Several measurements were made. The closest to Zapruder that the head in the bush can lie was in the middle of the sidewalk that runs from the top of the grassy knoll down to the street. The farthest away would be 10 to 15 feet beyond the sidewalk.\*

(327) Based on this analysis, an inspection of the Dealey Plaza survey map (fig. II-10, JFK exhibit F-133) revealed that the head in the bush was not in the bush at all. The bush lies between Zapruder and head, with the head itself an appreciable distance away from the bush. Accordingly, there was no evidence of a person actually hiding behind the bush.

(328) Having located the head, the linear feature purported to be a rifle was examined. The computer-enhanced image shows a number of linear features similar to the one near the head, all extending in the same general direction as the alleged rifle. Further, close inspection of the enhanced image shows that the narrow part of the linear feature (the alleged "barrel" of the rifle) passes in *front* of leaves in the bush. Since the head lies far on the other side of the bush, it was geometrically impossible for an actual rifle barrel near this head to be situated in front of any leaves in the bush.

(329) The panel concluded that the linear feature was not a rifle barrel; it was only one of a number of twigs in the bush, all characterized by the same general direction and spacing in the natural growth patterns of the bush.

(330) Additional processing work was done at the Los Alamos Scientific Laboratory to study the region of the linear feature. (121) This processing, which was based on the knowledge that similar objects reflect light in similar ways, has been applied by NASA in analyzing satellite photographs of the earth for natural resources. (122) The technique developed by NASA is known as spectral ratioing and involves a comparison of color measurements by dividing measurements of the color values. (123) The objective is to compare the different amounts of red, green, and blue light reflected by an object. This is done by obtaining a computer scan of the photograph's red, green, and blue components and then measuring each one.

(331) When the Los Alamos Scientific Laboratory applied this spectral ratio technique to Zapruder frame 413, it found that the ratios in the region of the thick part of the linear feature (the "rifle stock") were identical to the ratios of the light reflected from the Presidential limousine. (124) On the basis, the panel concluded that the "rifle stock" was only a hole in the bushes looking through to the limousine, which, by virtue of being coincident with a twig, created the false impression of a rifle. Thus, no evidence of a gunman was discerned by the panel.

## ADDENDUM A

### CALCULATIONS ON THE BOXES IN THE SIXTH FLOOR WINDOW

(332) The boxes visible in the Powell photograph that were not visible in the Dillard photograph\*\* appear to be equally in full Sun as

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\*See addendum B, par. 340 *infra*.

\*\*Two relevant photographs were taken by Dillard. This analysis is based upon the closeup view depicted in fig. IV-2.



are those seen in the Dillard photograph.\* This suggests that the additional boxes in the Powell photograph lie equally as close to the plane of the window as those visible in the Dillard photograph, ruling out the possibility of boxes very far inside the room being viewed by Powell from a viewpoint that was not available to Dillard. A simple calculation that can be used to place the two boxes visible in both Dillard and Powell shows that these boxes were very close to the plane of the window. This does not prove that the additional boxes in the Powell photograph lie equally close. Nevertheless, the appearance of being fully sunlit, without shadows from the window framing, strengthens the judgment that they do lie close to the plane of the window.

(333) Neither Dillard nor Powell had a camera angle perpendicular to the front of the depository building. Thus, they viewed objects in the windows from two different angles. As a convenient point of reference, the panel chose the triangular-appearing box corner that is visible in both the Dillard and Powell photographs at the lower right window frame. (See figs. IV-2 and IV-3.)

(334) The panel constructed the geometry seen in figure A-1 (*infra*). The diagram represents viewing angles from above the depository building, looking down, perpendicular to the horizontal plane of the street. The circular point *a* represents the corner of the box seen at the right of the windows;  $\alpha$  and  $\beta$  are the angles made with respect to a perpendicular between point *a* and the plane of the window. (The plane of the window is assumed to coincide with the outer brick wall of the depository.)

(335) The angles  $\alpha$  and  $\beta$  are not known precisely, since the exact positions of Dillard and Powell are unknown. They were crudely estimated in the following way. Dillard was riding in a press car behind the Presidential limousine; the position of the press car was approximately at the intersection of Houston and Elm when the picture was taken. Powell was on the east side of the intersection of Houston and Elm, and farther north than Dillard. Figure A-2 (*infra*) shows the approximate placement of the two photographers. The angles  $\alpha$  and  $\beta$  shown in figure A-1 were measured from A-1 to be approximately  $20^\circ$  and  $40^\circ$ . It is important to note that these are only approximations. The imperfect knowledge of the locations makes it probable that there could be a  $\pm 5^\circ$  to  $\pm 10^\circ$  error in each angle.

(336) In figure A-1, the distance "*d*" is the apparent displacement of the corner of the box in position between the Dillard and Powell photographs. The distance *x* is the distance from true perpendicular (perpendicular is  $\alpha=0^\circ$ ). The distance *h* is the distance behind the wall from which the corner of the box lies. It is measured from the box corner to the plane of the window.

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\*See par. 269 *supra*.

(337) From figure A-1, the following two equations can be formed:

$$\tan (\alpha)=\frac{x}{h}$$

$$\tan (\alpha+\beta)=\frac{x+d}{h}$$

Since  $\alpha$  and  $\beta$  are known, assignment of a value to  $d$  allows the two equations to be solved for the distance  $h$ . Solving the equations for  $\alpha=20^\circ$  and  $\beta=40^\circ$  gives:

$$\begin{aligned} h &= d / (\tan (\alpha+\beta)-\tan (\alpha)) \\ &= d / (1.37) \end{aligned}$$

(338) The distance  $d$  is measurable as a fraction of the window width. The window was known, from the Warren Commission measurements, to be 36 inches wide. The shift  $d$ , when converted to a fraction of the width of the window, yielded  $d \cong 8$  inches. Thus:

$$h \cong 5.8 \text{ inches,}$$

or the box corner lay approximately 6 inches behind the plane of the window.

(339) While there are appreciable uncertainties in these calculations, the location of the boxes within 6 inches of the plane of the window is consistent with their apparent photographic position in full sunlight.

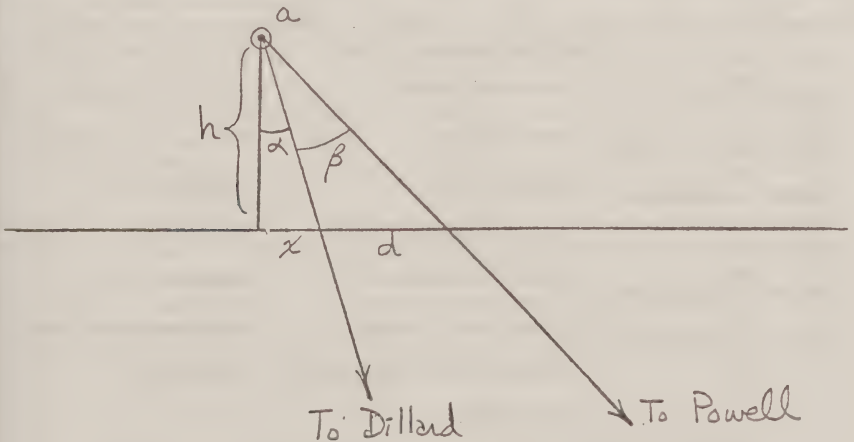
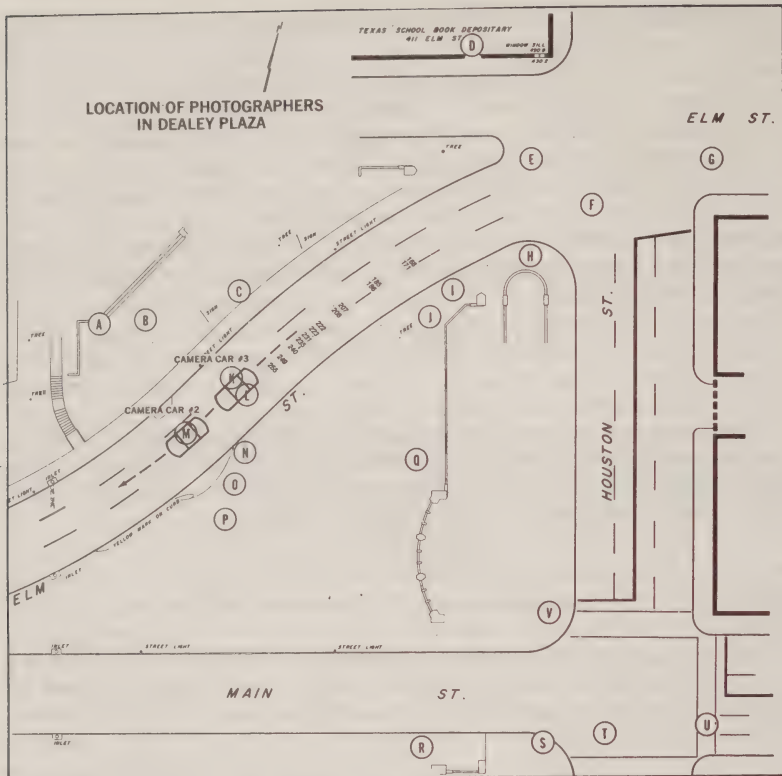


FIGURE A-1.—Viewing angles for Dillard and Powell photographs.



The twenty-two photographers in Dealey Plaza and where they stood.

<b>A</b> Zapruder (color movie)	<b>H</b> Martin (color movie)	<b>P</b> Bothun (black & white still)
<b>B</b> Cancellare (black & white still)	<b>I</b> Willis (color still)	<b>Q</b> Muchmore (color movie)
<b>C</b> Cablack (black & white still)	<b>J</b> Betzner (color still)	<b>R</b> Nix (color movie)
<b>D</b> Dorman (color movie)	<b>K</b> Underwood (black & white movie)	<b>S</b> Bell (color movie)
<b>E</b> Weigman (black & white movie)	<b>L</b> Couch (black & white movie)	<b>T</b> Hughes (color movie)
<b>F</b> Dillard (black & white still)	<b>M</b> Rickerby (black & white still)	<b>U</b> Weaver (black & white Polaroid)
<b>G</b> Powell (color still)	<b>N</b> Moorman (black and white Polaroid)	<b>V</b> Bond (color still)
	<b>O</b> Altgens (black & white still)	

FIGURE A-2

Source: Courtesy of Josiah Thompson, author of "Six Seconds in Dallas."

## ADDENDUM B

### CALCULATION OF HEAD SIZES IN ZAPRUDER FRAME 413

(340) Figure B-1 (infra) shows the geometry of the objects and camera focal plane. Head No. 1 is located at distance  $r_1$  and subtends an angle  $\theta_1$ . Head No. 2 is located at distance  $r_2$  and subtends an angle  $\theta_2$ .



The common focal length is  $f$ . It was assumed that both objects are equally focused (or equally out of focus). The image sizes in the two cases are  $d_1$  and  $d_2$ , respectively. It was also assumed that both heads have the same dimension  $d$ .

(341) Using the small-angle approximation:

$$r_1\theta_1 = d$$

$$r_2\theta_2 = d$$

Thus:

$$r_1\theta_1 = r_2\theta_2$$

and

$$\frac{r_1}{r_2} = \frac{\theta_2}{\theta_1} \quad (\text{A})$$

(342) In the image plane, however, the same small-angle approximations give:

$$f\theta_1 = d_1$$

$$f\theta_2 = d_2$$

Thus:

$$\frac{\theta_2}{\theta_1} = \frac{d_2}{d_1} \quad (\text{B})$$

Combining equations (A) and (B),

$$r_2 = \frac{d_1}{d_2} r_1.$$

This equation expresses the distance  $r_2$  as a fraction of the distance  $r_1$ , the fraction being the ratio of the measured head sizes in the image. Thus, the key to estimating  $r_2$  is to measure the ratio of head sizes.

(343) The measurement of the ratio of the head sizes is not simple because no other head in frame 413 is positioned the same as the "head-in-the-bush." Thus, it was necessary to make estimates of the head size of a person in the limousine. The estimation of head size is totally subjective as there was no analytical procedure to guide the estimates other than the obvious requirement that measurements of features be as comparable as possible for both heads. The width of the upper third of the head in the bush and the Secret Service agent climbing into the back of the limousine were measured because this portion of the head tends to be most spherical in shape, and hence, most invariant in size with respect to the viewing angle.

(344) The head in the bush, being nearest to the camera and largest in size, could be measured without appreciable error. The head of the Secret Service agent is partly obscured by leaves; therefore, three measurements were made corresponding to an estimate of the smallest head, the largest possible dimension, and a "best" guess. The measurements gave the following values for  $r_2$ :

$$r_2 = .38r_1, \text{ smallest estimate.}$$

$$r_2 = .44r_1, \text{ "best" estimate.}$$

$$r_2 = .50r_1, \text{ largest estimate.}$$

(345) These figures can be used to place the head on the line of sight. For example, in figure II-10, the distance from Zapruder to the limou-

sine would be multiplied by the fraction 0.38, and the corresponding distance measured along the line from Zapruder. The smallest value places the head in the center of the sidewalk.

(346) There are possible sources of error in these calculations, but it is important to note that any errors would have to be substantial to place the head in the bush. For example, the ratio of head sizes that would place the larger head within the bush would have to be approximately 0.20; that is, nearly 50 percent smaller than recorded for the smallest estimate of the Secret Service agent's head. It is believed that the probability of errors of this magnitude is virtually zero. The placement of the head beyond the bush is a certainty. The placement of the head beyond the retaining wall is almost as certain, since the corner of the retaining wall would correspond to a ratio of head sizes of approximately 0.25.

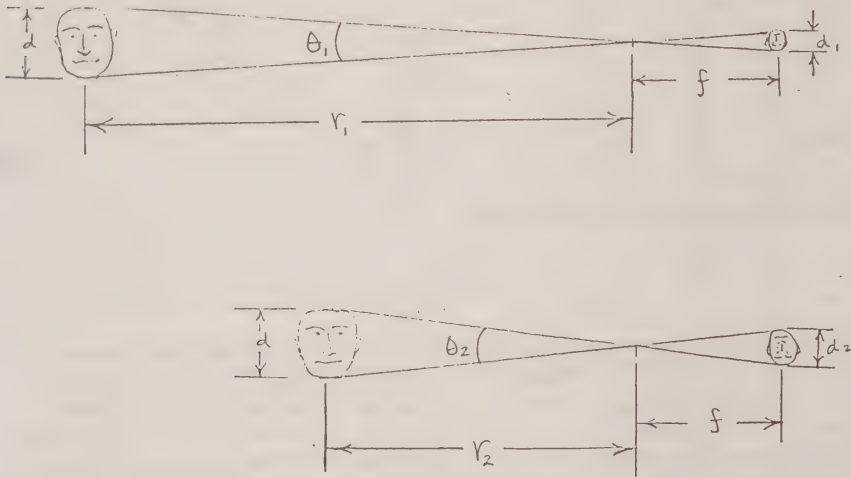


FIGURE B-1.—Head Size Calculation (Zapruder 413).

## B. Photograph Authentication

### 1. THE OSWALD BACKYARD PHOTOGRAPHS\*

#### (a) Introduction\*\*

(347) One of the most publicized questions to emerge in relation to the Kennedy assassination involves the authenticity of photographs showing Lee Harvey Oswald standing in his backyard, with a holstered pistol strapped to his waist, holding a Mannlicher-Carcano rifle

\*This section prepared under the direction of C. S. McCamy and Cecil Kirk, with the assistance of David Eisendrath. For related public hearing testimony of McCamy and Kirk, Sept. 14, 1978, see HSCA-JFK Hearings, vol. II, pp. 349, 397.

\*\*A glossary of terms is available in App. A of "The Backyard Pictures," Report to the House Select Committee on Assassinations by Dr. Leslie Stroebe, Mr. Andrew Davidlasy, and Dr. Ronald Francis, October 1978 (JFK Document No. 12902 [Hereinafter referred to as RIT Technical Report]). See par. 445 *infra*.

nd two newspapers. These have become known as the backyard photographs.

(348) Oswald himself, when shown the pictures at Dallas police headquarters after his arrest, insisted they were fakes. Through the years, many critics have argued the same thing. In part, the controversy was stimulated by a 1964 Life magazine cover of a copy of one picture, retouched to enhance its quality.

(349) If the backyard photographs are valid, they are highly incriminating of Oswald because they apparently link him with the murder weapon. If they are fakes, how they were produced poses far-reaching questions in the area of conspiracy. "Faked" backyard photographs would indicate a degree of conspiratorial sophistication that would almost necessarily raise the possibility that a highly organized group had conspired to kill the President and make Oswald a "patsy."

### *(1) History of the Backyard Photographs*

(350) In the early afternoon of November 23, 1963, Dallas detectives obtained a warrant to search the Paine residence in Irving, Tex., where Marina Oswald had been living. (125) The search concentrated primarily on a garage in which possessions of the Oswalds were stored. Among the belongings, Dallas police officials found a brown cardboard box containing personal papers and photographs, including two snapshots and two negatives of Oswald holding a rifle. (126) (Only one negative was made available to the Warren Commission; the other has never been accounted for.) (127)

(351) On the evening of November 23, 1963, Lee Harvey Oswald was shown an enlargement of one of the pictures. (That photograph was later designated by the Warren Commission as CE 133-A.) According to officers present, Oswald denied that he had ever seen the photograph and claimed that someone has superimposed his head on another person's body. Oswald was then shown the print (later designated as CE 133-B), which he also claimed was a trick photograph. (128)

(352) Marina Oswald was later questioned by the FBI about the photographs. She said that she had taken them in the backyard of the Oswald residence on Neeley Street in Dallas. (129) She gave, however, two different versions of when the pictures were taken. She first told the FBI it was in late February or early March 1963. (130) Her testimony to the Warren Commission reflected the same thing. (131) In an FBI interview made after her initial appearance before the Warren Commission, however, she said that the first time she saw the rifle was toward the end of March; she recalled having taken the photographs 7 to 10 days thereafter, in late March or early April. (132)

(353) Other evidence available to the Warren Commission supports her later version. A rifle and a revolver were shipped to Oswald from different mail order houses on March 20. (133) The left-wing newspapers Oswald is holding were dated March 11 and March 24 and were mailed on March 7 and March 21, respectively, both by second-class mail. According to postal authorities, both newspapers would have arrived in Dallas by March 28. (134) In addition, Marina claimed she remembered taking the photographs on a Sunday, about 2 weeks before Oswald allegedly shot at Gen. Edwin Walker on April 10. (135) From this information, the Commission deduced the likely date on which the photographs were taken to be Sunday, March 31, 1963. (136)



(354) In connection with the Warren Commission's investigation, Lyndal L. Shaneyfelt, an FBI photographic expert, performed an analysis on the two backyard prints designated CE 133-A and B, a negative, designated CE 749 (the original negative of CE 133-B), the Imperial Reflex duo lens camera (designated CE 750) that Marina Oswald testified she had used to take the pictures, (137) and the alleged assassination weapon (designated CE 139). His analysis and conclusions are as follows:

(355) (1) The photographs CE 133-A and B were taken with Oswald's Imperial Reflex Duo Lens camera. (138) Every camera has unique irregularities that are reflected on the margins of negatives made by it. Shaneyfelt determined that the margin irregularities of the original 133-B negative were identical to those of a negative that he exposed in the camera.

(356) Although he could not document absolutely the origin of CE 133-A because its negative was not available, Shaneyfelt concluded that both prints were taken with the same camera since they showed virtually identical background and lighting conditions. (139)

(357) (2) The backyard photographs CE 133-A and B are authentic. Shaneyfelt examined them under magnification and found no characteristics of compositing or retouching. (140) Initial public controversy regarding the authenticity of the backyard photographs arose after copies of CE 133-A, which appeared to differ in detail from the original photograph as well as from each other, particularly with respect to the configuration of the rifle, were published in Life, Newsweek and other news publications. (141) He testified that the apparent variations in the magazine versions were caused by retouching, a common practice in the reproduction of photographs for publication. (142)

(358) (3) The rifle in the backyard photographs is probably the rifle found in the Texas School Book Depository. Shaneyfelt photographed the rifle, attempting to duplicate the lighting and rifle's position in CE 133-A, and found the configurations matched those of the rifle in the backyard photograph. Although he found a notch in the stock of the rifle that appeared faintly on the rifle in the backyard photographs, he did not find enough peculiarities to state categorically that the rifles were identical. (143)

(359) Despite the Warren Commission's efforts to show that the backyard photographs were genuine, critics have persisted in doubting their authenticity. In general, the critics base their allegations of fakery on their observations of shadow inconsistencies, an indication of a grafting line between the mouth and chin, inconsistent head and body proportions, or a disparate square-shaped chin. (144)

(360) This position has received support from scientists who had not previously been associated with Warren Commission critics. For example, Malcolm Thompson, a British forensic photography expert, questioned in public the authenticity of the photographs in a 1978 British Broadcasting Corp. (BBC) television documentary. (145) At the request of the BBC, he had examined copies of the backyard photographs and concluded they were fakes.\* Similarly, a photographic analyst with the Canadian Department of Defense reached the conclusion that these photographs were composites. (146)

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\*The text of a statement by Mr. Thompson is available in app. B to RIT Technical Report. See par. 445 *infra*.

) *Additional photographic evidence recovered by the House Select Committee on Assassinations*

61) Marina Oswald, in addition to giving two different versions to when the backyard pictures were taken, gave different versions the number of pictures taken. At first, she testified she had taken one picture; (147) later she said it was two. (148) In addition, Marina Oswald testified that soon after the assassination she and Marina destroyed yet another picture in which Oswald was shown holding the rifle over his head with both hands. (149)

62) The committee obtained an 8 x 10 print of an additional view of Oswald holding the rifle in a pose different from CE 133-A or CE 133-B. This photograph, a first generation print, \* was given to the committee on December 30, 1976 by Mrs. Geneva Dees of Paris, Tex. According to Mrs. Dees, it had been acquired by her former husband, James White, now deceased, while employed with the Dallas Police Department at the time of the assassination. (150) The panel designated this recently discovered photograph as 133-C (Dees).

63) The committee obtained another first generation print of CE 133-A on April 1, 1977 from the widow of George de Mohrenschildt.

64) In the manuscript of his book, which he was writing at the time of his death in 1977, he stated that he and his wife had found a photograph in February 1967 among personal belongings they had stored in Dallas before departing for Haiti in May 1963. (152)

65) Two additional first generation prints, one of 133-A and one of 133-C, were obtained from former Dallas Police Detective Richard S. Stovall on April 14, 1978. (153) Stovall was among the police officers who discovered the backyard photographs during the search of the Paine premises. (154)

(b) *Issue*

66) Is there any evidence of fakery in the photographs of Lee Harvey Oswald that show him standing in a backyard holding a rifle in one hand and two left-wing newspapers in the other?

(c) *Materials and Procedures*

67) The Photographic Evidence Panel examined Warren Commission exhibits CE 133-A and 133-B, the two backyard pictures recovered from the Oswald residence by Dallas Police in 1963; CE 749, the original negative to CE 133-B, and CE 134, an enlargement of CE 133-A.\*\* In addition to these Warren Commission exhibits, the Panel analyzed the four photographs recently discovered by the committee:

68) (1) A photograph designated as 133A-de Mohrenschildt recovered from the estate of the late George de Mohrenschildt; (155)

69) (2) A photograph designated as 133C-Dees, obtained from Dees' widow; (156)

70) (3) Photographs designated as 133A-Stovall and 133C-Stovall, obtained from Stovall. (157) (See fig. IV-15, JFK exhibit F-15, for a display of all of these photographic materials except CE-134, which is shown in fig. IV-22.)

\* A first generation print is one made from the original negative.

\*\* CE 134 was examined by two panel members after the final panel conference in July 1978.

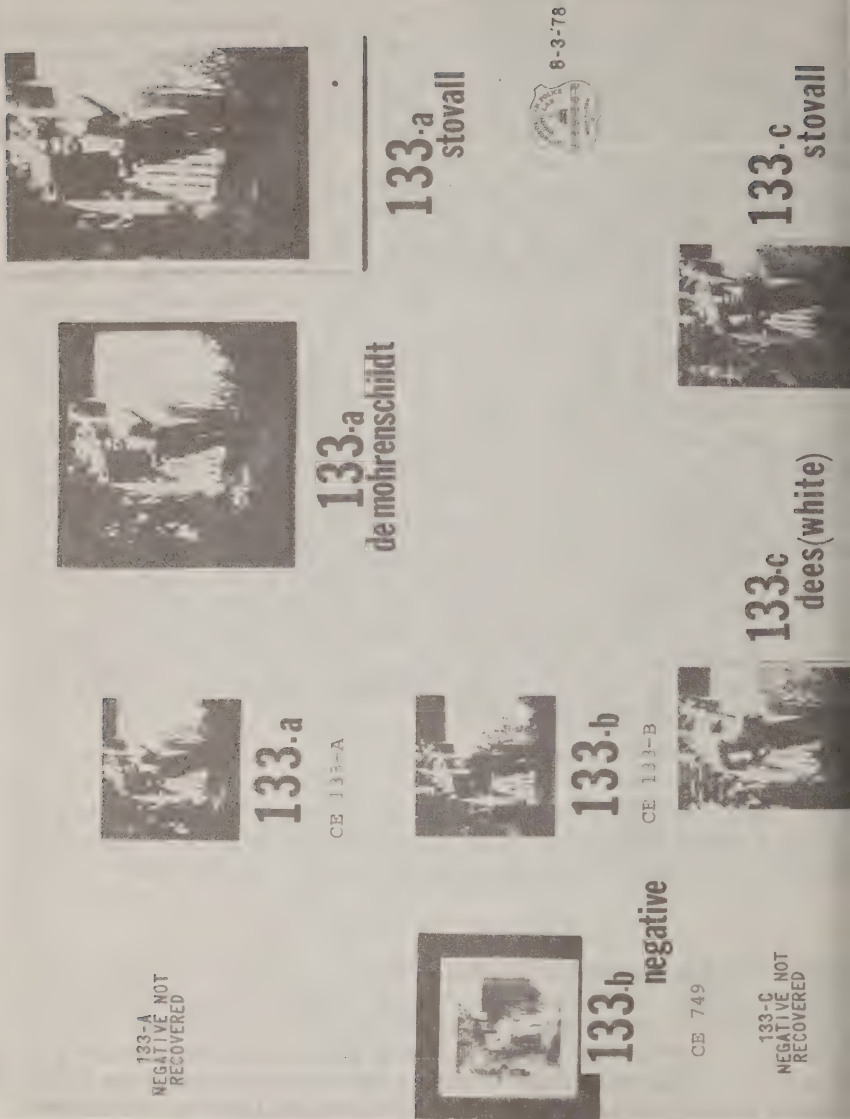


FIGURE IV-15.—Oswald “Backyard Pictures”—First generation prints and negatives examined by photographic evidence panel.

(370) These items were selected because of the Panel’s policy of working just with first generation prints and original negatives. (158) Only these types of materials contain the most reliable photographic information; subsequent generation materials tend to lose detail in highlight and shadow areas, suffer deterioration of tonal quality, and are prone to include new defects that may impair the accurate representation of the photographic image. CE 133-A, CE 133-B, 133A-de Mohrenschilddt, 133C-Dees, 133C-Stovall and CE 134 were identified



y the Panel as first generation prints. CE 749, the original negative to E 133-B, was the only negative recovered from the possession of the Dallas Police Department; consequently, it was the only original negative available to the Panel for analysis. There is no official record explaining why the Dallas Police Department failed to give the Warren Commission the other original negative. (159)

(171) In addition to studying the various backyard picture materials, the panel examined CE 750, which was alleged to be Lee Harvey Oswald's camera (160) to determine whether it was used to take the backyard photographs. Next, the negatives and photographs were visually inspected and compared with known photographs of Oswald. The panel's visual inspection included the use of magnifiers and microscopes. As an aid in this process, a series of enlargements varying exposures and contrast ranges was made of CE 133-A and 133-B, thereby producing prints which ranged from very light to very dark. (See figs. IV-16 and IV-17, JFK exhibits F-192 and F-193.) The detail in the darkest parts of the pictures could be most clearly seen in the lighter prints. The details in the lightest areas could be most clearly seen in the darker prints. In this way, the panel had the best opportunity of detecting any evidence of falsification anywhere in the pictures.



FIGURE IV-16.—CE 133-A printed at varying exposures and contrast ranges



FIGURE IV-17.—CE 133-B printed at varying exposures and contrast ranges.

72) In a further effort to locate unnatural edges or lines, as well differences in grain structure and contrast variations, the panel used digital image processing.\* The negative of CE 133-B was placed on a microdensity scanner so that light passing through the film could be measured. Such measurements were made on microscopic square areas that were positioned in a square-by-square pattern, but the actual squares were smaller than the silver grains on the negative. The meas-

\*See pars. 16-34, *supra*.



uring instrument determined how light or dark each microscopic square area was and expressed this as a number in a scale of 1,024 grades of density. As the film was scanned, the number for each square area was stored in the memory of a computer. The computer could subsequently recall the numbers, and cause a beam of light to expose a tiny spot on a piece of unexposed photographic film. Each small area was exposed to a magnitude corresponding to the relative lightness or darkness of the area on the original negative. When the exposed film was developed, it provided an enhanced copy of the original image.

(373) The computer was also programed to manipulate the data stored in its memory. It could produce a copy different from the original in some specified way: It could vary the contrasts; it could enlarge the image; or it could produce a more complicated derivation. It could be programed to search for edges between dark and light areas and to print a line on the copy at the place corresponding to the edge on the original.

(374) The backyard pictures were also visually inspected with stereoscopic techniques that permitted the prints to be viewed in three dimensions.\* This was possible because the camera's movement between exposures 133-B and 133-A resulted in two views, only a short distance apart, of a single scene. When these two pictures are viewed together in a stereo viewer, they give rise to a three-dimensional image. (161)

(375) This analytic technique is useful in the detection of fakery because photographs of prints (i.e., a photographic copy of a photograph), when viewed in stereo, will not project a three-dimensional image unless made from different viewpoints along one axis.\* Further, any retouching of an original photograph of a scene can be detected because when two photographs of that scene are viewed in stereo, the retouched item will appear to lie either in front of, or behind the plane in which it should be lying. It is virtually impossible to retouch one or both images of a stereo pair with enough skill to escape detection when viewed stereoscopically.

(376) Finally, in addition to these methods of visual inspection, the materials were studied photogrammetrically. "Photogrammetry is the science of ascertaining the positions and dimensions of objects from measurements of photographs of these objects." (162) In the Oswald backyard pictures, photogrammetry was given particular emphasis in studying critical shadow areas.

#### (d) Conclusion

(377) The panel detects no evidence of fakery in any of the backyard picture materials.

\*This principle of stereoscopy is discussed in pars. 76-78 *supra*.

\*\*Identical photographs or photographs made from the same camera position will not generally exhibit stereoscopic characteristics. Nevertheless, if a camera is stationary and photographs of a subject that moves are viewed stereoscopically, the subject may exhibit three-dimensional properties, while the background will not.

(e) *Analysis*1) *Production and development of prints*

78) The photographic prints examined by the panel were not of uniform size. These variations reflected differences in how each had been produced and developed. CE 133-A and 133-B were considered to be drugstore or photofinisher prints because they appeared to have been produced on the type of commercial photoprinting machine used by photofinishers for camera stores, drugstores and mass-produced prints.

79) The photographs show a slight variation in the horizontal and vertical dimensions of the prints and borders that were caused by artifacts of masking position. On the back of each is the small graphite mark characteristic of automatic printing machines. It indicates to an electronic eye scanner where the long continuous roll of prints should be cut into individual snapshots. (See figs. IV-18, IV-19, JFK exhibits 179 and F-182.) As most drugstore prints, these were apparently cropped slightly for aesthetic purposes by placing a white border around their periphery. Finally, the panel noted that CE 749, the negative to CE 133-B, contained small emulsion tears, which indicated that it had been abused in processing, as well as water spots indicative of improper washing or drying.

80) CE 133-A and 133-B were determined to be first generation prints because of the presence of very fine lines and marks that were occasioned either by scratches on the film, which were caused by the camera, or by torn or broken emulsion from the negative that occurred during development. Marks so fine and sharp would not have appeared on a second generation print.

81) On review of 133A-de Mohrenschildt (see figs. IV-20 and IV-21, JFK exhibits F-382 (front) and F-383 (reverse)), the panel concluded that it had been probably made in a high quality enlarger with a high quality lens. Nevertheless, the print has become yellowed with the passage of time, indicating that it was not adequately fixed or washed during the development process.

82) The uncropped black border around the edge of this print indicates that it was projected in an enlarger with a negative carrier that was larger than the actual full size negative of CE 133-A. This type of equipment might be found in a graphic arts shop or photo printing shop that uses many sizes of negatives. It is also possible that a paper easel might not have had the capability of masking a print to size. As a result, the entire negative area is printed and the unused border area outside the full camera aperture has been recorded as black on the print. Because people normally like to have white borders on their pictures, this is an unusual way of presenting a photograph. The sharpness of the markings (from the film scratches) within the black border, as well as the presence of fine scratches and emulsion tears, indicates that this is a first generation print.

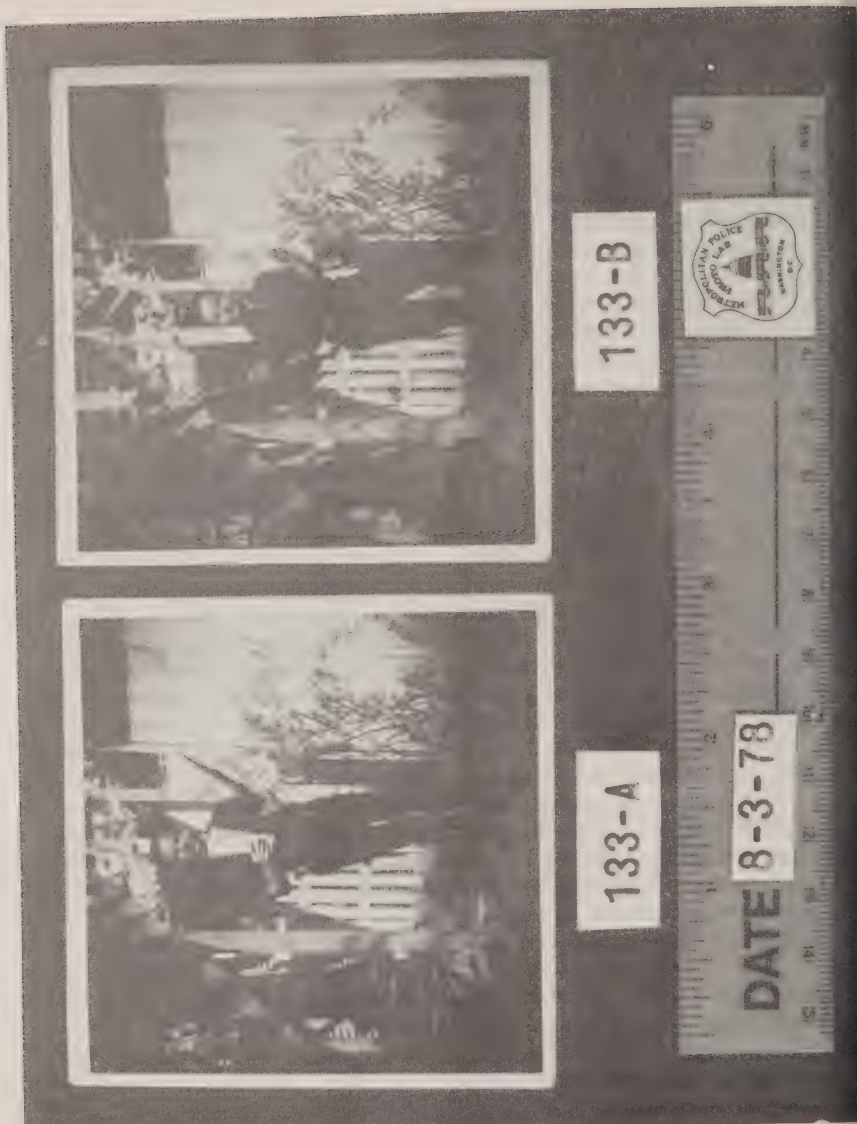


FIGURE IV-18.—CE 133-A and 133-B (front).



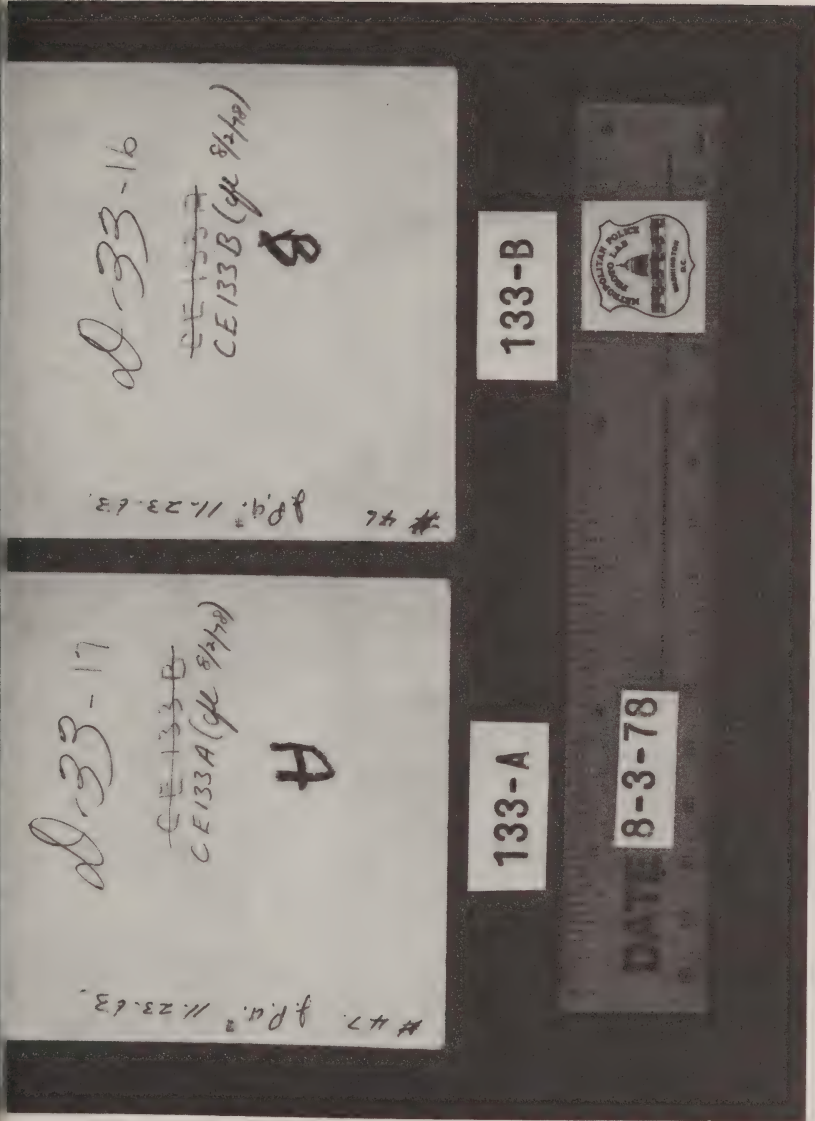


FIGURE IV-19.—CE 133-A and 133-B (back).

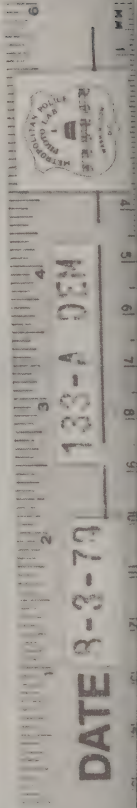


FIGURE IV-20.—133-A (de Mohrenschildt) (front).

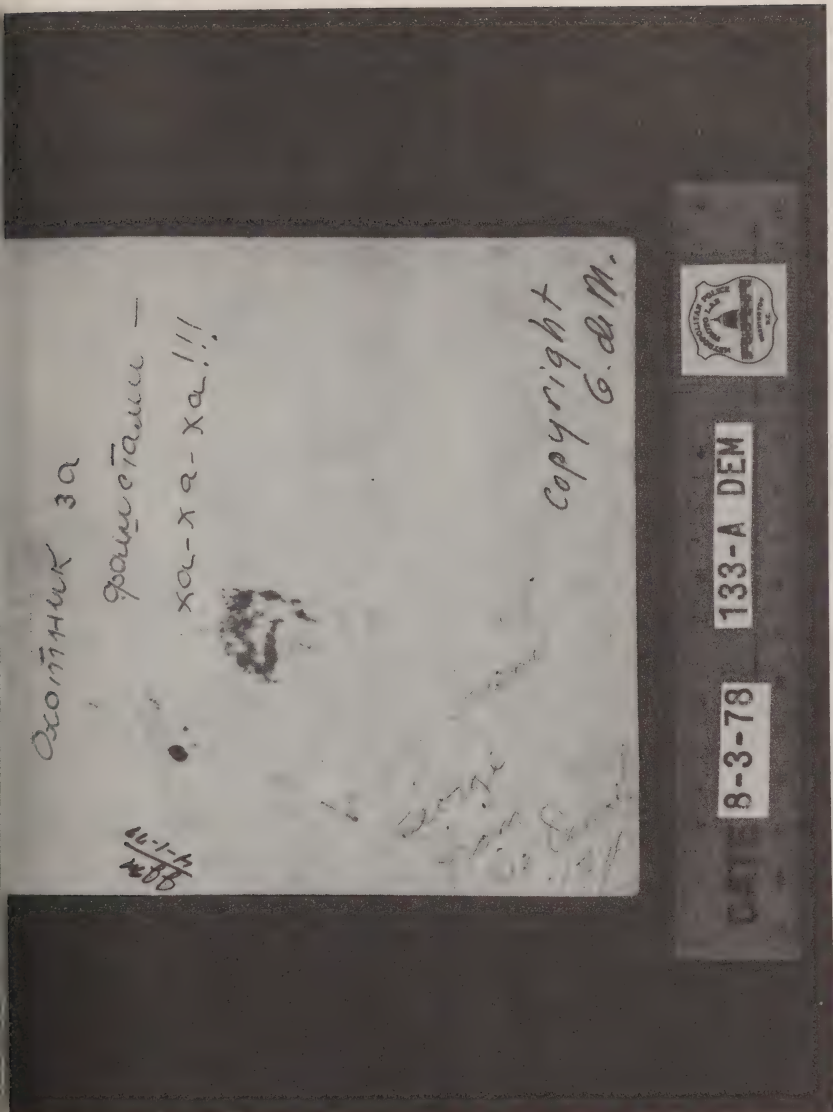


FIGURE IV-21.—133-A (de Mohrenschildt) (reverse).

83) The 133A-Stovall print is approximately 5 by 8 inches. (See : IV-22, JFK exhibit F-185.) This is not a standard size for photographic paper. The person who made the print probably took a standard size sheet of 8- by 10-inch paper and cut it in half. Across the bottom border of the print is a black line. The lower right area of the right border above the black line bears a black circle. The black border on the bottom was caused by light spilling over the bottom border of the easel mark because the mask was not wide enough to cover it. Furthermore, since the mask contained a small rivet with a hole through it, the paper extending under this rivet hole allowed the



light from the enlarger to print the image through the rivet hole. These markings are actually sharper than the photographic image. The Panel established that this print was also a first generation print again because of well-defined markings and emulsion tears.



FIGURE IV-22.

(384) Since the original negative to CE 133-A was square shape (see fig. IV-20, JFK exhibit F-382), and because 133A-Stovall rectangular (see fig. IV-22, JFK exhibit No. F-185), it is apparent that the Stovall picture has been cropped with a standard white border for aesthetic reasons.

35) The 133C-Stovall and 133C-Dees prints (see fig. IV-15) appear to have been cropped for aesthetic reasons in a manner similar to 133A-Stovall. Moreover, because these two prints had the well-defined emulsion tears and scratches on them as the other first generation prints, they are likewise considered to be first generation. Both are enlargements from the original negative.\*



FIGURE IV-23.—CE-134 (front).

Dallas police officer R. L. Studebaker testified to the House Select Committee on Assassinations that in 1963, while working in the Dallas Police Department Photography Laboratory, he made numerous copies of the Kennedy photographic evidence for fellow Dallas police officers; included in the pictures distributed were prints of CE 133-A and CE 133-B as well as of the third pose not shown by the Warren Commission. Testimony of R. L. Studebaker, *supra* note 127.



FIGURE IV-24.—CE-134 (back).

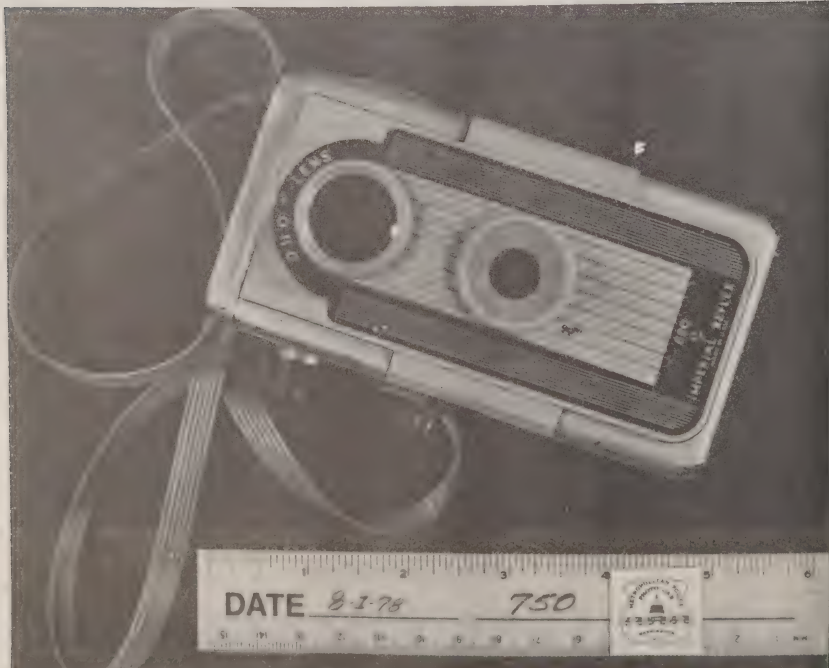


FIGURE IV-25.—CE-750. Imperial Reflex camera.



(386) Finally, CE 134 is an 8- by 10-inch enlargement of the CE 133-A negative. (See fig. IV-23.) It apparently was reproduced by the Dallas Police Department by enlargement from the original negative with an easel set that accommodated 8- by 10-inch enlarging paper. The back of the photograph contains an impression from a rubber stamp identifying the Dallas Police Department. (See fig. IV-24.) The emulsion scratches and tears are again evidence that this is a first generation print.

(2) *The Imperial Reflex Camera*

(387) Marina Oswald testified to the Warren Commission that CE 750, an Imperial Reflex camera (see fig. IV-25) was used to take the backyard pictures. (163) In order both to test the credibility of her testimony and to establish the conditions under which fakery might have occurred, the panel conducted a series of tests to determine whether this camera had, in fact, been used to take the backyard pictures. (164) The tests sought to establish whether any of the unique identifying marks of the camera could be found on the backyard picture materials.

(388) Most cameras, particularly inexpensive ones which have been manufactured by injection molding of plastic, have certain imperfections in them such as bumps, notches, nicks, scratches, edge irregularities, et cetera. These imperfections frequently are located on the film plane aperture against which the film lies when it is exposed. As a result of the contact between the film plane aperture and the film, some of these imperfections may be recorded on the border of the film's image area. These imperfections are known as frame edge markings. They are not of concern to camera manufacturers because most customers who use such cameras will have photofinisher prints made which have white borders that crop off the frame edge marking irregularities.

(389) Such markings, however, will remain on the negative and any uncropped prints. Because these markings on inexpensive cameras tend to be distributed in a random pattern unique to each camera, they serve as identifiers for determining whether a particular negative or uncropped photograph was originally exposed in any particular camera.

(390) Another type of camera signature may occur in inexpensive cameras when the film is dragged across the edge of the plastic as it is moved from the supply chamber to the film plane aperture and then to the take-up chamber. This process often causes fine scratches on the emulsion side of the film that may then appear on the actual photographic image. These scratches may coincide with the particular pattern of the plastic molding of the camera. They can serve as unique marks for camera identification.

(391) In order to determine the pattern of these camera signatures in the case of CE 750, Oswald's Imperial Reflex camera, test photographs were made with it and then intentionally underexposed in development to show the frame edge markings better. (No special development method was necessary to bring out the camera scratch mark pattern.) (See fig. IV-26, JFK exhibit No. F-190). Each time the film was run through the camera, the camera signature created by the frame edge markings and scratch marks was found to be the same. (165)

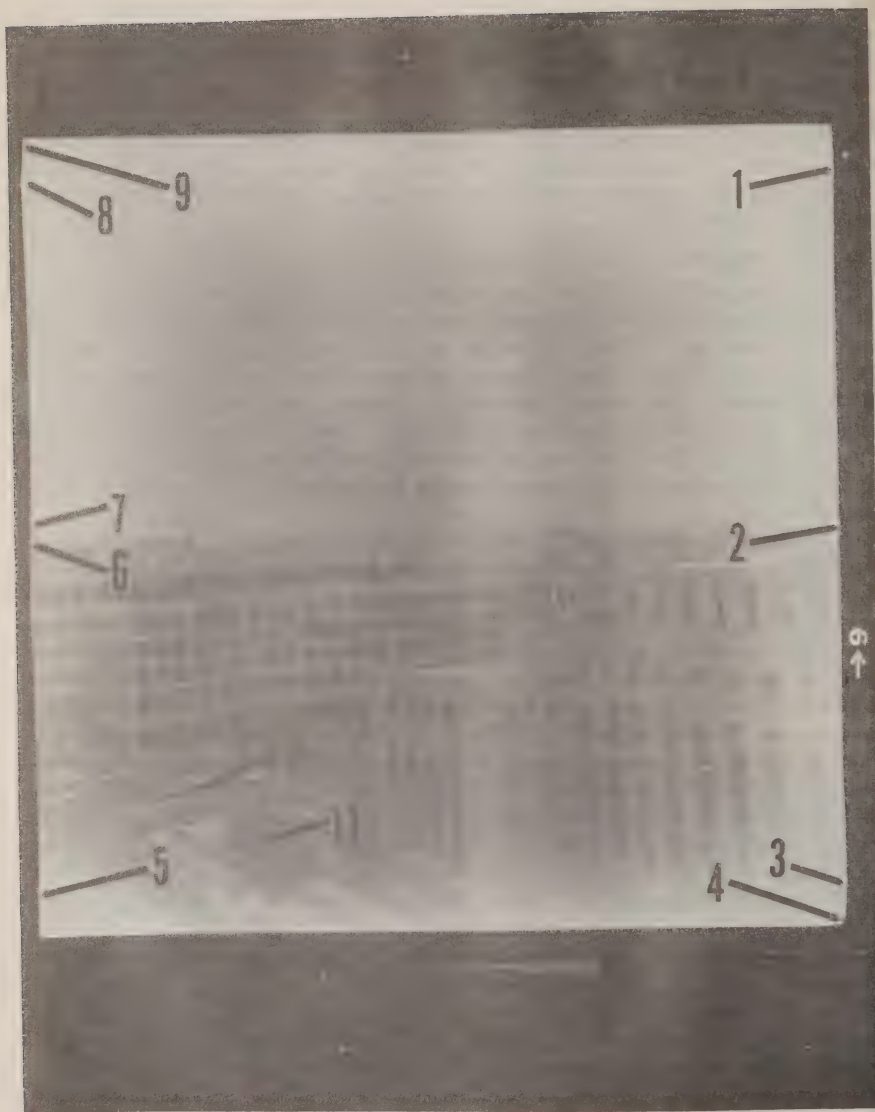


FIGURE IV-26.—Test photograph exposed in Oswald Imperial Reflex camera (CE-750).

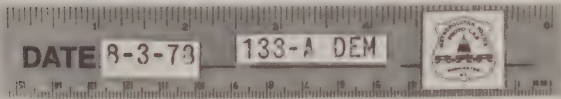


FIGURE IV-29.—Frame edge markings and camera scratch marks on the de Mohrenschildt print of CE-133-A.





FIGURE IV-27.—Test photograph exposed in another Imperial Reflex camera.



FIGURE IV-28.—Frame edge markings and camera scratch marks on negative of CE-133-B (CE-749).



FIGURE IV-30.—Oswald family photograph with same frame edge markings and camera scratch marks as others exposed in CE-750.

(392) The next step was to verify that this frame edge mark pattern and the scratch marks were unique to CE 750. This was done by comparing the test pictures with photographs that had been exposed in two duplicate Imperial Reflex cameras obtained from the Eastman Kodak House in Rochester, N.Y. In each case, the camera signatures were markedly different. (166) The comparison thus confirmed that CE-750 had unique frame edge markings and scratch marks. (See fig. IV-27, JFK exhibit F-191.) (167)



(393) Because only the 133-B negative (CE-749) and the uncropped 133-A de Mohrenschildt print contained a full image area showing the frame edge markings, only these were compared for frame edge markings with the test photograph. In the case of the 133-B negative, 11 unique identifying frame edge marks were found which corresponded with the test photography. (See fig. IV-28, JFK exhibit F-188.) These identifiers were also present in the 133-A de Mohrenschildt print, although the panel notes that in this case, a light box and magnifier were necessary to detect all of the marks. (See fig. IV-29, JFK exhibit F-397.) (168)

(394) These results were confirmed by the panel's scratch-mark analysis. Here, all the backyard picture materials could be reviewed because the scratch marks that were the subject of the analysis had not been cropped out by any of the prints' white borders. The analysis clearly indicated that the scratch marks were located in precisely the same location in each photograph. (See figs. IV-26, 28, and 29.) (169)

(395) This analysis established that the Oswald backyard pictures had been exposed in Oswald's Imperial Reflex camera.\*

### 3. ALLEGATIONS OF FAKERY

#### (a) *Unnatural lines in the vicinity of Oswald's chin*

(396) It has been alleged that there is a line that runs directly across Oswald's chin and is evidence of compositing. No unnatural line indicative of fakery could be discerned by the panel on either the original negative or first-generation prints when these materials were visually inspected using magnifying and microscopic equipment, varying density exposures, and digital image processing. (171)

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\*In regard to the allegation that this camera had been used only to take the incriminating backyard pictures of Lee Harvey Oswald, the panel examined all of the photographic material in the National Archives that was listed as having been taken from the effects of Lee and Marina Oswald during the execution of post-assassination searches by the Dallas Police Department. Most of these were family-type snapshots, including scenes of an older child and baby in a crib, Marina Oswald playing with a child, and Lee Oswald holding an infant. The frame edge markings appearing on the negatives to these photographs and the camera scratch marks appearing directly on the pictures were studied and found to be entirely consistent with both the original test materials and the Oswald backyard pictures which were exposed in the Oswald Imperial Reflex camera. For example, figure IV-30 (JFK exhibit F-189) is a photograph which has been identified by Marina Oswald Porter as depicting one of the two children that she had by Lee Harvey Oswald. (170) The negative of figure IV-30 was found to contain the same camera identifiers and scratches as the other first generation prints and original negative made in the Oswald camera. It is, therefore, apparent that this photograph was also taken by Oswald's Imperial Reflex camera.



FIGURE IV-31.—Grain structure analysis of CE 133-B utilizing digital image processing.

(397) As noted earlier, photographic images such as the backyard pictures are composed of very small, irregular shaped grains of silver suspended in a gelatin layer. On a given photograph, a uniformly exposed area has a generally uniform distribution of such grains. In contrast, on composited photographs, the grain distribution may be noticeably different. When the panel microscopically examined the area above and below the horizontal chin cleft in the backyard pictures, no difference in grain structure could be found. (172) (See fig. B-16, JFK exhibit F-197.)

(398) The 133-B negative (CE 749) was digitally processed at the Aerospace Corp. and the University of California Image Processing Institute using several different image-processing techniques. This process confirmed that the grain distribution was uniform. (173) (See fig. IV-31, JFK exhibit 197.) Under very carefully adjusted display conditions, the scanned image of the Oswald backyard negative did exhibit irregular, very fine lines in the chin area. The lines appeared, however, only with the Aerospace gradient-enhancement process, where the technique was applied at a much higher resolution (i.e., the image area scanned was magnified since only a small portion of the picture was being subjected to the computations).

(399) Although the cause of these lines has not been definitely established, there is no evidence to indicate that they are the result of an attempt to fake the photograph. This is because similar, although less pronounced, lines were found using the same digital enhancement technique on a known authentic photographic negative. Therefore, those lines may have been a product of the enhancement process.

(400) Supporting evidence for this conclusion is that the fine lines were not observed in photo-optical photochemical enhancements or in phase-contrast microscopic inspection of the chin area. In addition, the lines are disconnected; they do not cross the entire chin and are extremely fine, roughly equal in width to the size of the grain clumps in the emulsion.

(401) Three other possible causes for the lines are suggested:

(402) (1) They could be due to the presence of very fine scratches on the glass plate used to support the film while it was being scanned;

(403) (2) They could have been introduced during the film drying process. Particulate and dissolved material in the film wash water can leave a so-called water stain on film. As the water evaporates, the particulate and dissolved material is deposited on the emulsion, usually in thin, irregularly shaped lines. The probability of the lines being caused by very faint water stains is heightened by the observation of very noticeable stains in the neck and ear area, as discussed below.\* These marks are found in the work of photographers who pay inadequate attention to the washing and drying steps in the processing of film;

(404) (3) Changes in emulsion temperature during processing can cause silver grains in the emulsion to clump together in fine linear patterns, an effect known as reticulation.

(405) While subsequent generation prints of the backyard pictures appear to show a line running across Oswald's chin, (174) this phenomenon is not surprising because copy prints often have higher contrasts than originals. If an object or an original photograph of the object has a rather diffuse band that is dark at the center but becomes progressively lighter at the edges, a photographic or printed ink copy very often will show that band as a distinct line with sharp edges. In generating a copy photograph, the photographic or printing process may not be able to depict the entire tone range of the original object or photograph. In that case, a range of lighter tones will all appear as a single light tone and a range of darker tones will all appear as one dark tone. It is in this way that a broad smooth tone scale becomes a sharp transition from dark to light. This apparently happened in copies of the Oswald photographs, causing the shadow across the chin to appear to be a sharp line. Accordingly, no probative value can be attributed to such materials.

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\*See pars. 406-407 *infra*.





FIGURE IV-32.—Water spot analysis of 133-A Stovall.

(406) The Panel did note a very fine line on an enlargement of CE 133-A. It ran from the edge of Oswald's left ear into the chin area and continued downward and around to form an irregularly shaped, closed ring. If this were a photographic image of a line where parts of a picture had been pasted together, the image of the line would be composed of photographic silver grains. Here, however, the line was actually finer than the silver grains and was continuous rather than beaded and broken as it would have been had it been composed of silver grains. Experienced photographic technicians recognize this type of line as the edge of a water spot. (See fig. IV-32, JFK exhibit F-196.)

(407) When the negative was developed, fixed, and washed, a spot of water was left on the film surface. As it dried, it left a mineral residue and/or microscopic distortion of the gelatin surface surrounding the area where the drop had been located. Because very similar configurations were seen on more than one of the 133-A prints, the defect must have been on the original negative. Images of similar water spots were found on the image of the shirt at the left shoulder and on the image of the stock of the rifle. Similar water spots were observed as well as on the negative of CE 133-B (CE 749) on prints made from that negative, and on 133-C.

(408) Moreover, on comparing the backyard prints with known photographs of Oswald, the Panel observed that he quite clearly had a natural line running across his chin. (See fig. IV-33, JFK exhibit No. F-194.) It appears in the photographs as an indentation.





CONSULADO DE CUBA

Solicitud de

Fecha: \_\_\_\_\_

Nombre: \_\_\_\_\_

\_\_\_\_\_

Ciudadanía: \_\_\_\_\_

Fecha y hora: \_\_\_\_\_

Presentación: \_\_\_\_\_

Permisionista: \_\_\_\_\_




FIGURE IV-33.—Oswald photographs depicting chin characteristics.



(409) The chin area of the backyard pictures has also generated controversy because of the allegation that the chin appears rather flat across the bottom, whereas in other photographs it is more pointed, or at least rounded, with a vertical cleft at the bottom. It has been asserted that the chin in the backyard prints actually belongs to another man.

(410) A profile photograph taken by the Dallas Police Department, shows that the lower half of Oswald's chin had a roughly cylindrical protrusion with a horizontal axis. (See fig. IV-33, JFK exhibit No. F-194.) When the chin was lighted by direct sunlight coming from nearly overhead, the protrusion cast a shadow over the bottom part of the chin. The upper edge of the shadow was a nearly straight horizontal line. The bottom of his chin, like his eyes and neck, is in such deep shadow that it is not visible. Thus, the shape of Oswald's chin and the type and direction of illumination are responsible for the relatively flat appearance of his chin.

*(b) Unnatural and inconsistent shadows*

(411) An argument has been advanced that some of the shadows cast by Oswald and other objects in the backyard prints contain no detail and consequently must have been painted on a montage. (175) In addition, the directional consistency of the shadows both in terms of the objects casting them and with respect to each other has been challenged. (176)

(412) The first of these claims was found to be false simply by studying the prints of CE 133-A and CE 133-B that had been made at varying exposures to facilitate examination for detail. The prints of normal and greater than normal lightness revealed great detail in the shadow areas. (See figs. IV-16, IV-17, JFK exhibit Nos. F-192-193.) Grass, a small branch, what appear to be stones, clods or parts of leaves, and a newspaper can be seen. Blades of grass are silhouetted against the edge of the newspaper.

(413) This aspect of the photographs appears normal. The shadows are illuminated by light reflected from the white or light-colored picket fence and wall in the background. For this reason, the shadows on the ground are not as dark as the shadows over the eyes and throat that did not receive such illumination. The detail within the shadows and the variations in density between them preclude the possibility that they were painted onto a montage. (177)

(414) The consistency of the shadows was also evaluated by application of the vanishing point principle. The concept of "vanishing point" perspective is widely known with respect to artists and applies to photography as well. (178) This concept simply means that parallel lines in object space are depicted as converging lines on the image which will eventually meet at a point. Because the Sun's distance from Earth is so great that it may be considered infinitely distant, it follows that, in any sunlit scene, lines from objects to their shadows are parallel. When these parallel lines are pictured, the corresponding lines on the picture converge at a point known as the vanishing point. A picture of parallel railroad tracks provides a good illustration; the tracks are seen to converge to a point at the horizon.

(415) In the case of the railroad tracks, the vanishing point is in the picture. This may not always occur. If the lines are perpendicular to the camera axis (the line from the center of the lens to the center of the film), the images of the lines will not appear to converge at a point on the picture. The vanishing point may then be considered to be at infinity. In other cases, where the parallel lines are not perpendicular to the camera axis, the vanishing point is either in the picture or some finite distance outside it.

(416) When this is the case, the directional consistency of shadows may be tested by drawing lines from images of objects to the corresponding points on the images of their shadows, and then extending these lines (beyond the actual picture if necessary) to see if they all meet at one point. If the lines do meet at one point, they are parallel and therefore consistent. If they do not meet at one point, they are not parallel and consequently are not consistent.

(417) When this analysis was applied to the backyard prints by drawing lines from a part of the stairway, the butt of Oswald's pistol, the muzzle of the rifle, Oswald's nose, et cetera, to the corresponding points on the shadows cast by these objects, the lines all met at the vanishing point. (See figs. IV-34 and IV-35, JFK exhibits Nos. F-387 and F-388.) Accordingly, the shadows were determined to be directionally consistent. A vanishing point analysis on 133C (Stovall) also yielded consistent results.

(418) While the vanishing point analysis settles this issue, comparisons between shadows depicted in different backyard pictures cannot be validly made unless the illumination, precise geometry of the head and the exact location of the camera are considered. It is for this reason that the allegation of fakery, based on the observation that a shadow has not moved between pictures despite movement of the object casting it, is fundamentally misconceived. The argument fails to account for the compensating effect of movement by the camera. (179) This principle is illustrated in the RIT Technical Report, pars. 470-74 *infra*.



133-B

FIGURE IV-34.—Vanishing point shadow analysis.





133-A

FIGURE IV-35.—Vanishing point shadow analysis.



FIGURE IV-36.—Third backyard picture pose “133-C.”

(419) Finally, the shadows in these pictures were also analyzed to determine the sequence in which the photographs were taken. A visit to the Neeley Street site of the backyard photographs established that a person walking up the steps would be walking almost straight east. (180) Given the view shown in the backyard photographs, it is possible to estimate that the camera was aimed about  $70^\circ$  east of north. The shadows in the photographs indicate that the Sun was

behind and to the right of the camera. Since this would place the Sun in the southwestern sky, it was afternoon, and the Sun was going down.

(420) In the photographs, three horizontal linear shadows may be seen crossing the post in the foreground of the pictures and continuing along the ground behind the subject. These may have been shadows of power cables or some similar object. There is a knot in the post between the lower two shadows that may be used as a visual reference point. The shadows are lowest relative to the knot on 133-C, highest on CE 133-A, and in an intermediate position on CE 133-B. The Sun position would cause the shadows in the backyard pictures to move upward on the post with the passage of time. Therefore, since the shadows were moving upward, 133-C was taken first, followed by CE 133-B, and then CE 133-A. (See figs. IV-18, IV-20, and IV-36.) (The possibility of additional intervening photographs cannot be discounted.)

(421) The photographic technique improved appreciably during the sequence. For 133-C, the camera was not held level and the subject was not centered. The camera was rotated slightly as the shutter release was pressed. This caused the detail to be fairly sharp in the vicinity of the bush shown at the right, corresponding to the axis of rotation, while there is rotational blur elsewhere, such as in the area of the steps. In CE 133-B, the camera was held level and steady, but the subject's feet were not in the field of view. For CE 133-A, the camera was held reasonably level and steady, and the subject was well centered.

### (c) *Evidence of retouching*

(422) Each of the backyard pictures, as well as the only original negative, was examined microscopically for evidence of retouching. No such evidence could be detected. Particular attention was given to the area to Oswald's left in CE 133-B, where it has been alleged that a retoucher painted on a montage but carelessly allowed the color material to spread onto the front of a nearby vertical post, thereby giving the appearance of an indentation on the post that does not appear in either of the other two backyard pictures. (181)

(423) Close examination of the original print revealed that the apparent indentation is a shadow, most likely of a leaf or leaves. The straight edge of the post is still visible in this shaded area. This straight edge was detected and indicated by a computer programed to seek such edges. (See fig. IV-37, JFK exhibit F-198.) (182)





FIGURE IV-37.—Edge analysis of CE 133-B utilizing digital image processing.

(424) The other two pictures, CE 133-A and 133-C, show that the post casts a shadow on the white surface behind it. The shadow is wide enough to fill the image area between Oswald's neck and post. Consequently, since the darker area to the left of the post is the shadow of the post on a white surface, a shadow falling on the white post itself would be similar in tone to the background and could be mistaken as part of the background rather than as a shadow on the post.

(425) Finally, careful inspection detects a crooked linear image of what appears to be a thin branch or a wire clothesline in this picture. The image of this line runs continuously through the area in question between Oswald's neck and the post. It is unlikely that a retoucher who would faithfully preserve detail as fine as this wire would fail to follow the straight edge on the post. (183)

*(d) Oswald's identical heads and inconsistent body proportions*

(426) Allegations have been made that Oswald's head appears to be absolutely identical in each of the backyard pictures examined by the Warren Commission and that this is evidence of a single head being used for the compositing of CE 133-A and B. (184) Further support for this argument has been advanced by Warren Commission critics who have maintained that in each of the pictures Oswald's head is the same size, even though the length of his body varies considerably. (185)

(427) There is no support for the statement that Oswald's head is identical in each of the backyard pictures. If anything, the photographs showed a marked variation in facial expression. For example, in CE 133-A Oswald is smiling, whereas in CE 133-B he appears to be frowning. (See figs. IV-18 and IV-20.)

(428) The panel was aware that various techniques involving the use of transparency overlays have been used in an effort to demonstrate that the three different heads are really one. (186) When soft-edged images such as pictures of the spherical human head are the subject of analysis, the absence of a sharp demarcation for comparison precludes such methods from serving as an accurate basis for making comparisons. Even so, when the transparency overlay method of analysis was undertaken by the committee's contractors, the differences in the shape and size of Oswald's head became readily apparent. (187)

(429) The argument that there is evidence of fakery because Oswald's head size is the same in each of these pictures, although his body size changes, was found to be erroneous for several reasons. First, any measurements of Oswald must take into consideration variations attributable to his degree of tilt. (188) Second, even when the tilt factor is ignored, Oswald's head length measures differently in each of the photographs.\* Finally, there is nothing unusual about a series of photographs in which head length appears to remain the same even though the subject's body length seems to vary. Because of its rigid structure, the head when photographed (even with a marked change of expression) is subject to considerably less variation in length than

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\*For Oswald head length measurements taken from CE 133-A and B, see table I. "Comparison of Oswald Photographs," par. 732, *infra*.

the rest of the body, which tends to be affected more by variations in posture. (See fig. IV-38.)

430) When the panel reviewed previous studies analyzing the relative proportions of Oswald's body length to the length of the rifle depicted in the pictures, (189) it became apparent that these analyses had also failed to consider variations in posture and effect of tilt on the apparent length of a photographed image. Moreover, variations in Oswald's posture as depicted in these pictures make such an analysis meaningless.



GOVERNMENT OF THE DISTRICT OF COLUMBIA

METROPOLITAN POLICE DEPARTMENT

WASHINGTON, D. C., 20001



FIGURE IV-38.—Effect of postural and facial expression variations on statural and facial measurements taken from photographs.

*(e) The identical backgrounds*

431) The allegation has been made that the backgrounds in these pictures are identical and that three differently posed subjects had been superimposed on copies of one background picture. (190) The proponent of this theory, however, had never measured the distance between any relevant reference points in these pictures to determine whether there had been camera movement between the taking of each photograph. (191) Had this been attempted, the analysis would have revealed both horizontal and vertical movement between pictures.

432) The panel determined that there had been horizontal camera movement. It measured the difference in alinement between pictures of particular foreground and background objects. For example, the prominent post in the foreground of each picture has a picket fence on both sides of it. The term "a" was designated as the distance from



the left edge of the image of the post to the left edge of the left-hand picket at the end of the fence, "b" as the distance from the right edge of the image of the post to the right edge of the image of the right-hand picket. If the camera had moved between exposures, the ratio of "b" to "a" should differ between viewpoints in different pictures.

(433) This ratio was measured at three different heights on corresponding places on CE 133-A and B, and in all three instances a measurable difference was found. A similar technique was used with similar results to determine that there had also been vertical camera movement between pictures.\*

(434) In addition, the panel observed, as noted above, that the backgrounds in these pictures contained such different shadow patterns that the time sequence in which these photographs were taken could be determined. Shadows of leaves on the wall behind Oswald also differ noticeably in these pictures.

(435) Finally, because of the movement of the camera between exposures, these photographs could be viewed three-dimensionally in stereo pairs. When this is done, the post properly appears to stand out in front of the fence, while the fence in front of the buildings is positioned further back. Many of the dark areas that look like leaves on the bush on the right (and consequently make the foliage appear to be unseasonably thick) are found to be shadows of these leaves on the wall behind the bush; the bush and its leaves stand out from the wall, whereas the shadows lie flat against it. If a single photograph of the backyard had been taken and several copies of it then made, the photographs when viewed together stereoscopically would have exhibited no difference in alinement between foreground and background objects. It would be obvious that it had been a flat photograph that had been rephotographed, rather than the real, three-dimensional backyard.

(436) The finding that the backgrounds of these two photographs can be viewed stereoscopically has an important bearing on the question of authenticity. The falsification of stereo pairs would require extremely precise positioning of all points in one image relative to the points in the other. An error in the relative positions would be readily detected because, when the pair is viewed together, erroneously placed points would appear to lie either in front of or behind the plane in which they should be lying. It is unlikely that a sophisticated conspirator would attempt to falsify images by producing a stereo pair, since one picture would obviously be sufficient, easier to produce, and less susceptible to detection.

#### 4. PRACTICAL CONSIDERATIONS

(437) Beyond the evidence produced by the use of the various photographic analyses, which did not detect any evidence of fakery in the backyard pictures, several practical considerations reinforce these conclusions. For example, the FBI established that the newspapers that appear in the photographs did not reach Oswald until March 27, or 28, 1963, and the committee determined that by April 5, 1963, Oswald had already autographed the back of one of the pictures (133A-DeM). (192) Aside from the obvious

\*See addendum A, pars. 440-445 *infra*, for horizontal and vertical parallax measurements.

question of whether Oswald would place his signature on a fake picture, for the photograph to have been faked would have required access, within just a 10-day period, to Oswald's backyard, his camera, rifle (knowing that this would be the assassination weapon), and newspapers.

(438) While such access without Oswald's knowledge would theoretically have been possible, it is regarded as unlikely. Moreover, a fundamental question is whether a sophisticated conspirator would expose himself to unnecessary risks of detection by making three fake photographs, when just one would suffice. Using stereoscopic analysis, any inconsistent evidence of fakery would be detected, as literally floating in the image space of the photograph.

(439) Another important consideration mitigating against fakery is the obvious improvement in quality as the sequence of photographs progressed—133C, CE 133-B, and CE 133-A. Quite clearly a learning process was taking place, as the photographer determined, among other things, how the subject could best be centered in the field of view. Finally, the presence of graphite marks on CE 133-A and CE 133-B strongly suggests that the prints were routinely developed by a drugstore or camera store photofinisher's laboratory. It is unlikely that a sophisticated conspirator would have given the end product of his doctoring efforts to a drugstore for printing. Malcolm Thomson, the British forensic photography expert who publicly questioned the authenticity of the backyard picture, was shown a preliminary summary of the panel's report and asked to comment. He was also offered an opportunity to appear before the committee to express his views. After studying the reports, Thomson deferred to the panel's conclusions that the photographs revealed no evidence of fakery. He noted the thoroughness of the panel's investigation and emphasized that his earlier comments were based upon examination of copies of the photographs rather than the original material. Thomson did, however, reserve his opinion that the chin in the backyard pictures was suspiciously different from the chin that he had observed in the Dallas arrest photographs of Oswald. He also remained skeptical as to the ability of a computer to detect a photocopied composite photograph. (193)

The photographic analyst with the Canadian Department of Defense who had stated that there was evidence of fakery in these photographs was also contacted by the committee. He indicated that he had performed no scientific tests on the photographs and had spent less than an hour examining the "very poor copies" that were submitted to him. (194)

## ADDENDUM A

### MEASUREMENTS OF HORIZONTAL AND VERTICAL PARALLAX\*

(440) Both the horizontal and vertical parallax between the two Oswald backyard photographs CE 133-A and 133-B were measured. This was done by measuring the difference in alinement between particular objects in the foreground and background. The post, prominent in the foreground of each picture, has a picket fence behind it

\* Parallax is "[t]he apparent shift in relative position (or shape) of an object when it is viewed from different positions." L. Stroebel and H. N. Todd, *Dictionary of Contemporary Photography* (1974).



and extending to both sides. The post and fence provided clearly delineated and easily identifiable corresponding points for measurement of horizontal movement (i.e., horizontal parallax) of the camera between exposures. A horizontal part of the fence and the lower edge of the screen of a screen door in the background provided points for measurement of the vertical parallax.

(441) Horizontal parallax was measured at three different heights on the picket fence: the lower level was just above the top edge of the lower horizontal member of the gate; the middle level was in line with the lower edge of the middle horizontal member of the gate; the upper level was in line with the lower edge of the top horizontal member of the gate. (The four pickets and the three horizontal members give the appearance of a gate because they are evenly spaced, but actually they stand at an angle to the vertical member seen alongside the post in the foreground.) At the lower and middle levels, the distance "a" from the left edge of the foreground post to the left edge of the picket to the left of it was measured, and the distance "b" from the right edge of the foreground post to the right edge of the picket to the right of it was measured. At the upper level, because the right edge of the right-hand picket falls into shadow and is not clearly delineated, the distance between the right edge of the foreground post and the right edge of the second picket, which appears to be the first picket of the gate, was measured. The results of the measurements and computations are as follows:

	a equals (mm)	b equals (mm)	b/a equals
Lower level:			
133A.....	6.8	9.0	1.32
133B.....	6.0	9.5	1.58 1.32/1.58=0.84
Middle:			
133A.....	6.5	9.3	1.43
133B.....	6.4	10.0	1.56 1.43/1.56=0.92
Upper:			
133A.....	7.0	22.7	3.24
133B.....	5.9	23.6	4.00 3.24/4.00=0.81

(442) In all cases, more of the background is shown to the right and less to the left on CE 133-B as compared to CE 133-A. Since the shadow analysis indicated that CE 133-B was taken before CE 133-A, the parallax indicates that the camera was moved slightly to the left between these two exposures. The ratios shown at the far right of the table of values differ for two reasons. The sharpness of the edges to which measurements were made was quite poor, so that the difference between the measurements at the lower and middle levels is probably largely experimental error. The measurement of the upper level, as noted, was actually a measurement that used a different reference point and, therefore, would not be expected to result in the same ratio.

(443) Vertical parallax was calculated by measuring the vertical distance from the center of the dark horizontal object, which looks like it might be a gate bolt or latch, to the bottom edge of the screen of the screen door in the background. To establish scale, that is to take into account differences in magnification, these measurements were related to the distance from the left edge of one picket to the left edge of the next, measured in a horizontal direction. This scaling distance was measured on the two center pickets of the four that appear to consti-



ute the gate at the level of the lower edge of the top horizontal member. The results are as follows:

133A : gate bolt to screen = 30.4 mm, scaling dist. = 15.5 mm

$$30.4/15.5=1.96$$

133B : gate bolt to screen = 32.1 mm, scaling dist. = 15.2 mm

$$32.1/15.2=2.11$$

(444) Since less background appeared above the gate bolt on 133A than on 133B, the camera was moved slightly downward between these two exposures. Less certainty can be attached to this determination than to the determination of horizontal parallax for two reasons. Only one, rather than three determinations, was made. Second, in the horizontal case, the determination was made more sensitive to parallax because, as the camera moved, the picket to the right became narrower, while at the same time the picket to the left became wider. Thus, in the ratio  $b/a$ , the numerator was diminishing as the denominator grew. This double effect was not present in the determination of vertical parallax. Nevertheless, there is additional evidence of vertical parallax. Between the first and second pickets from the left in the gate, just below the bottom edge of the upper horizontal member, a small black rectangle appears. It appears more elongated in the vertical direction on CE 133-A, as one would expect if the camera were moved down between exposures, exposing more of the dark area in the background.

## ADDENDUM B

### REPORT TO THE HOUSE SELECT COMMITTEE ON ASSASSINATIONS U.S. CONGRESS—HOUSE OF REPRESENTATIVES

#### THE OSWALD BACKYARD PHOTOGRAPHS

(By Dr. Leslie Stroebel, Mr. Andrew Davidhazy, Dr. Ronald Francis)

#### *The Oswald Backyard Photographs*

#### INTRODUCTION

(445) This report deals with the authenticity of the photographs of Oswald in a backyard, including prints of three different views and a negative of one of these views. Twenty-two specific questions concerning the authenticity of these photographs were presented to the undersigned by the photographic panel. Most of the questions are related to claims made by various persons in the mass media that fakery was involved in the production of the photographs.

(446) The questions are numbered and a response, with a description of the test procedures used and our conclusions, follows each question. Illustrations are included with some of the responses. The first number in each illustration caption is the same as the number of the corresponding question. Three illustrations are also included as part of this introduction. Figure RIT 0-1 serves to identify the three different views of Oswald and the only negative that has been located. Figures RIT 0-2 and 0-3 are enlargements of two of the views which the reader may find useful for reference purposes. A glossary is included as an appendix for readers who are unfamiliar with any of the photographic terms used in this report.



**133.a**  
stovall



**133.a**  
de mohrenschildt



**133.a**  
CE 133-A



**133.b**  
CE 133-B



**133.c**  
dees(white)

133-A  
NEGATIVE NOT  
RECOVERED



**133.b**  
negative  
CE 749

133-C  
NEGATIVE NOT  
RECOVERED

FIGURE RIT 0-1.—Identification of the three different views of Oswald in a backyard and the only negative recovered.



FIGURE RIT 0-2.—An enlarged copy print of original print CE-133B.



FIGURE RIT 0-3.—An enlarged copy print of original print CE-133A.



## OSWALD BACKYARD PHOTOGRAPHS—QUESTIONS AND RESPONSES

(447) 1. Was the negative of Oswald exposed in the Oswald camera? (The negative is identified by the Archives number CE-749, and it corresponds with the print identified by the number CE-133B. The Oswald camera is an Imperial Reflex duo lens camera that uses 620 size film.)

(448) When negatives that were exposed in the Oswald camera by the undersigned were compared with the negative of Oswald, similarities in the edge markings from irregularities in the film aperture and scratch patterns indicated that the negative of Oswald was exposed in the Oswald camera. In addition, variations in sharpness from the center to the edges, and pincushion distortion were similar on the original and comparison negatives.

(449) 2. Do the edge markings on the FBI print (made from a negative exposed in the Oswald camera by the FBI) agree with the edge markings on the negative of Oswald (CE-749)?

(450) We had intended to make a quantitative comparison of the edge markings on the various photographs, as suggested by a panel member, by alining pairs of edge markings, measuring the displacement at fixed intervals and calculating the standard deviation. Careful examination of a roll of film we exposed in the Oswald camera revealed that while the distinctive marks appeared consistently on each frame of film, the straightness of the lines varied considerably—apparently due to slight buckling of the film. Instead, we made prints that compare pairs of edges on all four sides of the picture frame.

(451) By combining positive and negative images, it was possible to show the comparison as the two edges of a single black line. Figure RIT 2-1 shows a comparison between a print made by the FBI from Archives negative CE-749 (outside edge) and a print made from the the same negative at RIT (inside edge). In order to show all four edges it is necessary to make the inner image slightly smaller than the outer image, resulting in a slight displacement of markings near the ends of each edge. The distinctive markings on the inner and outer edges of the black line agree closely as would be expected if the two prints were both made from the same negative.

(452) There are two obvious discrepancies that we consider to be insignificant. (1) When one edge of the two images is alined, there is a slight lack of parallelism on the other three edges. Since the two prints were made with two different enlargers, any deviation from exact parallelism of the negative and the easel on either enlarger, a not uncommon defect in enlargers, would produce this effect. (2) There is an obvious difference in the vertical to horizontal proportions of the two images. The dimensional stability of photographic paper during processing and drying is different in the direction of the paper grain as opposed to across the paper grain. The difference in proportions is consistent with expectations if the paper grain were oriented vertically on one print and horizontally on the other.

(453) Figure RIT 2-2 shows a comparison between a print of an unidentified man on a roof made from a negative exposed in the Oswald camera by the FBI (outside edge) and a print of Oswald made from Archives negative CE-749 by the FBI. The similarities of the markings indicate that both were made with the Oswald camera. Figure

RIT 2-3 shows a comparison between film exposed in the Oswald camera at RIT (outside edge) and the Archives negative of Oswald, CE-749. Again, the distinctive markings are in close agreement indicating both negatives were made in the same camera.

454) 3. Are the edge markings produced by the Oswald camera unique or are they similar to markings produced by other samples of the same brand of camera?

455) When two other samples of Imperial Reflex duo lens cameras, obtained from the International Museum of Photography at the George Eastman House (IMP-GEH), were compared with the Oswald camera, it was found that all of the bodies were produced by injection molding of plastic. This produced three circular indentations on each side of the film aperture that tended to distort the otherwise essentially straight edge. The details of the distortions in these areas, however, were distinctively different on the three cameras. These differences in shape can be seen by examining the images through a low power (5-10X) magnifier. The most distinctive differences, however, are the two projections, one on each side, near the bottom of the Oswald camera image which are missing on the two IMP-GEH cameras. Figure RIT 3-1 shows a comparison between one of the IMP-GEH cameras (inside edge) and a negative exposed in the Oswald camera at RIT.

456) 4. Does the image sharpness at the center and edges of the negative of Oswald (CE-749) appear to be consistent with that of other negatives made with the Oswald camera?

457) Yes. Photographs taken with the Oswald camera by the undersigned revealed strong curvature of field, which accounts for much of the falloff in sharpness toward the edges. Photographs made with the two IMP-GEH Imperial Reflex duo lens cameras also revealed strong curvature of field. These cameras have no focusing adjustment and no aperture adjustment to control depth of field. With curvature of field the camera focuses on nearer objects at the edges of the picture than in the center. At the distance Oswald was standing from the camera, he appears sharper than objects near the edges at approximately the same distance. If the camera had been moved somewhat closer to Oswald, however, curvature of field would cause him to appear less sharp than objects at the edges which were at the same distance. Thus, the relative sharpness at the center and edges of photographs made with these cameras varies with the object distance. In figure RIT 4-1, the curved plane of sharp focus in object space is behind the wall in the center causing unsharpness in this area, is at the wall in a circular area midway between the center and the edges producing a sharp image, and is in front of the wall at the edges again causing unsharpness.



FIGURE RIT 2-1.—Comparison of edge markings on a print made by the FBI from Archives negative CE-749 (outside edge of black line) and a print made from the same negative at RIT (inside edge).





FIGURE RIT 2-2.—Comparison of edge markings on a print made by the FBI from a negative exposed in the Oswald camera by the FBI (outside edge) and a print of Oswald made from Archives negative CE-749 by the FBI (inside edge).



FIGURE RIT 2-3.—Comparison of edge markings on a negative exposed in the Oswald camera at RIT (outside edge) and the Archives negative of Oswald, CE-749, (inside edge).



**FIGURE RIT 3-1.**—Comparison of edge markings on a negative exposed in an Imperial Reflex duo lens camera owned by the International Museum of Photography at the George Eastman House (inside edge) and a negative exposed in the Oswald camera at RIT (outside edge).



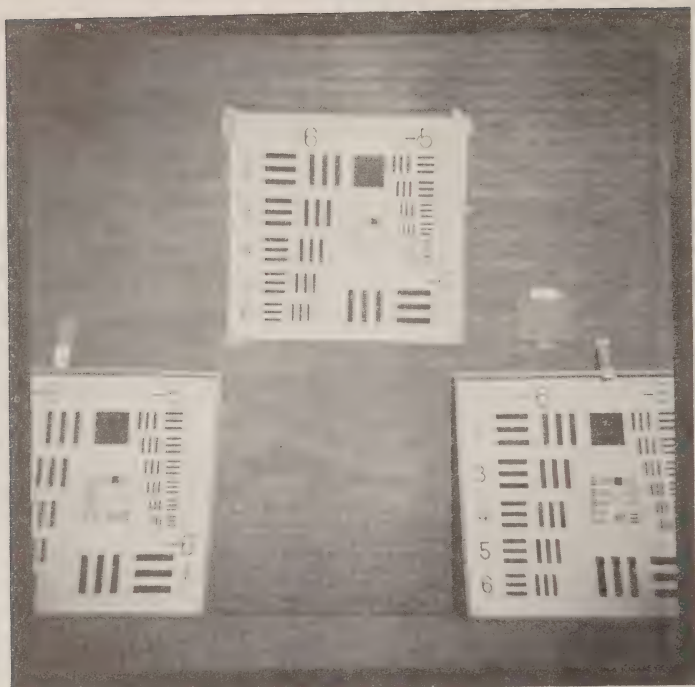


FIGURE RIT 4-1.—Photograph made in the Oswald camera at RIT illustrating curvature of field of the camera lens. The camera is focused behind the wall in the center and in front of the wall at the edges. The sharpest focus at the wall is in a circular area midway between the center and the edges.

(458) 5. Could the scratches on the negative of Oswald have been produced by the Oswald camera?

(459) Film exposed in the Oswald camera by the undersigned revealed scratches similar to those on the original negative of Oswald. Some scratches did not extend the full length of the film, but when 8 x 8 inch prints made from the original negative and one of the above comparison negatives were carefully alined, four prominent scratches were in the same locations on both prints—at 36, 45, 52, and 112 mm from the left edge of the picture area (fig. RIT 5-1). Scratches were detected on both the emulsion side and the base side of the negative of Oswald (CE-749), but the scratch lines that are evident on the prints correspond to those on the emulsion side of the negative. The fact that four prominent scratches were in the same locations on a print made from the negative of Oswald and a print made from a negative we exposed in the Oswald camera completely satisfied us that the scratches on the negative of Oswald were produced by the Oswald camera.

(460) 6. Do other samples of the same brand of camera produce similar or identical scratches?

(461) Obvious scratches were produced by one of the two Imperial Reflex duo lens cameras obtained from IMP-GEH but not by the other (figs. RIT 6-1 A and B). The camera that produced the obvious scratches had a badly warped back that put excessive pressure on the film and made it difficult to advance the film. The scratch pattern produced by this camera was not at all similar to that produced by the Oswald camera. We conclude that film scratching with this brand of camera is not the result of a manufacturing defect, in which case similar scratch patterns could occur with different cameras, but rather is the result of changes that may occur on an individual basis as the cameras are used over an extended period. It seems that the plastic used in the camera body and back can soften and be deformed when subjected to elevated temperatures, as was evident on one of the two IMP-GEH cameras, placing excessive pressure on the film as it is advanced in the camera.



FIGURE RIT 5-1A.—Print made from the negative of Oswald (CE-749) for scratch comparison with a negative exposed in the Oswald camera at RIT. Four prominent scratches were found to be in the same locations on both prints.



FIGURE RIT 5-1B.—Print made from a negative exposed in the Oswald camera at RIT, at the same scale of reproduction as the accompanying print made from the negative of Oswald.





FIGURE RIT 6-1A.—Print made from a negative exposed in the first of two Imperial Reflex duo lens cameras owned by IMP-GEH. This camera had a badly warped back. The scratches are in different locations than those on prints made from negatives exposed in the Oswald camera.



FIGURE RIT 6-1B.—Print made from a negative exposed in the second IMP-GEH camera. Only faint, transient scratches were produced by this camera.

(462) 7. Can the scratches on the negative of Oswald be enhanced?

(463) There are procedures for enhancing scratches. Since it was felt that a positive identification had been made in the response to question 5 above, these procedures were not employed. Also, we noticed that the fine scratches on the film we exposed in the Oswald camera tended to be less continuous than the four obvious scratches we measured and therefore they would be less useful for identification purposes.

(464) 8. Are any scratches continuous on the body, head, and background on the negative of Oswald?

(465) Apparently there was concern about the scratches not only for the purpose of determining if the negative of Oswald had been exposed in the Oswald camera (discussed in 5 and 6 above) but also to provide information concerning the possibility that a composite image had been made—such as a head or figure from one photograph and the remaining parts from another. For this second purpose, a continuous scratch on the head, body, and background would limit the options by which a composite could have been made. If, for example, a scratch were detected running from the top edge to the bottom edge of a print but stopping abruptly at the head, there

would be reason to suspect that a head had been transplanted from another photograph. Or, if such lines were detected on the negative of Oswald but they were evident only as light or dark streaks with no indication of physical damage to the film surface, there would be reason to suspect that the negative was a copy negative rather than an original, and that some fakery was involved. No evidence of such scratch marks was detected. In the present case, since it could be seen that the scratches were actually on the surface of the negative of Oswald, they simply confirm these marks were caused by the camera and, as such, that the negative was indeed exposed in the Oswald camera. None of these scratch marks were suggestive of compositing. Similarly, the scratch marks on the prints were caused by the effect of the camera on these negatives, and thus are not evidence of fakery but rather serve to confirm that Oswald's camera was used to take these pictures.

(466) 9. Are there any differences in the grain pattern in the areas of the body, head, and background on the negative of Oswald?

(467) No inconsistencies could be detected between the areas mentioned with examination of the original negative through a 30X magnifier, on normal contrast enlarged prints, or on high contrast enlarged transparencies (figs. RIT 9-1 A and B).

(468) 10. Are the backgrounds identical in the three different views of Oswald in the backyard (CE-133A, CE-133B, and CE-133C)?

(469) The backgrounds are not identical on the three photographs, but the differences are those to be expected as a result of a change in the position or the angle of the camera with respect to the scene. We could not detect anything that would suggest the background itself (as distinct from the photographs of the background) had been changed in any way—as by the addition, removal, or alteration of any of the parts. Also, we could not detect any evidence of fakery either in the background areas of the photographs or in the figures. (Also see question 15 below.)

(470) 11. Are the nose shadows compatible with the other shadows in the scene?

(471) The positions of the shadows under the nose, eyebrows, and chin all appear to be consistent with the other shadows in the scene. In addition, the sharpness of the edges of the shadows and the contrast of the shadows with the surrounding areas appear to be consistent.

(472) We were subsequently asked to respond to the statement in the caption on page 191 of *JFK: The Case for Conspiracy* by F. Peter Model and Robert J. Groden, which compared CE 133-A and 133-B. "In the bottom photo [CE 133-B], Oswald's head is cocked slightly to his left, yet the shadow directly under his nose (see top closeup of CE 133-A) moves—not in relation to the light source but to the angle of his head."

(473) It is true that if the tilt of the head were the only change made between the two photographs, the nose shadow would point more toward the left side of Oswald's mouth (on the viewer's right) in CE 133-B where the head is tilted. However, turning the head from left to right (as distinct from tilting it) also alters the placement of the nose shadow. The authors understandably did not take this factor into account because Oswald's head seems to be facing directly toward the camera on both photographs. In actuality, however, the position of Oswald and/or the camera has changed slightly as evidenced by the



change in the position of the post behind Oswald. If we assume that the camera was moved a short distance to the viewer's left for CE 133-B, Oswald would have to turn his head to his right in order to be facing the camera and this would move the shadow back toward the original position shown in CE 133-A. Also, moving the camera to the left or moving Oswald to the viewer's right would produce the observed change in the relative positions of the post and Oswald's head.



FIGURE RIT 9-1A.—Enlarged print on normal-contrast photographic paper from the negative of Oswald (CE-749), used to determine if there are any differences in the grain pattern in the areas of the body, head, and background. No inconsistencies were detected.



FIGURE RIT 9-1B.—Enlarged transparency on high-contrast photographic film for grain pattern check. No inconsistencies were detected. (The original transparency provides the best detail when viewed by transmitted light.)



1. Head vertical. Shadow points toward center of mouth. 2. Head tilted. Shadow points toward left side of mouth.

FIGURE RIT 11.—Four photographs made to demonstrate that the change in the position of the nose shadow produced by tilting the head can be nullified by rotating the head as an explanation for the similarity in the positions of Oswald's nose shadow in views CE-133A and CE-133B.



3. Head tilted and rotated. Shadow points toward center of mouth, but head is not facing camera. 4. Moving camera to left restores full front view. Shadow points toward center of mouth with head tilted.

(474) Four photographs were made of a manikin head to illustrate the explanation given above:

Figure RIT 11-1. The nose shadow falls straight under the nose with the head in the vertical position.



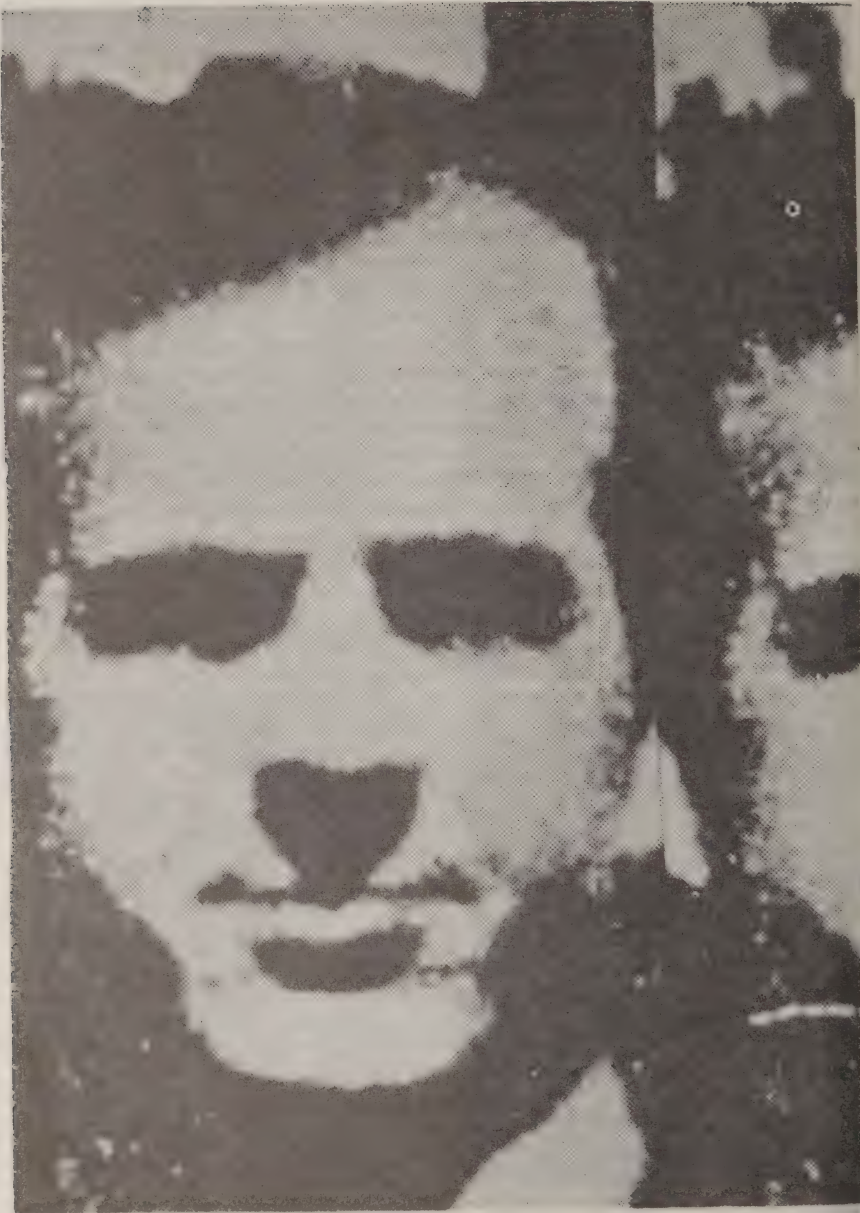
Figure RIT 11-2. Tilting the head to the viewer's right by placing a pencil under the opposite side causes the nose shadow to move noticeably toward the left side of the manikin's mouth.

Figure RIT 11-3. Rotating the head to its right returns the shadow to the original position, but the manikin is no longer facing the camera.

Figure RIT 11-4. Moving the camera to the left produces a full front view of the head with the shadow in the original position even though the head is tilted. Also, the background has moved to the left in comparison with the head, as in the photographs of Oswald.

(475) 12. Is there any evidence of a line in the chin and neck area that would suggest the picture is a composite?

(476) We found no evidence of a line suggesting a composite had been made in our examination of the only original negative available (CE-749) (without magnification and at 30X magnification) and of normal-contrast prints and high-contrast prints at either low or high magnification. We made a copy of the reproduction of a portrait of Oswald from page 192, "JFK: The Case for Conspiracy," by F. Model and R. Groden in which the authors claim the chin has been transplanted (fig. RIT 12-1). For comparison purposes we made enlargements at about the same scale from copy negatives of prints CE-133A, CE-133B, and CE-133C (fig. RIT 12-2). The enlargement of the head from CE-133C is less sharp than the other enlargements because when the original 8 x 10 inch print was made, the enlarger was not focused accurately, and the original negative has not been located.



The world's first chin transp  
head from CE-133A; the

FIGURE RIT 12-1.—Photographic copy of the reproduction of print of Oswald (CE-133A) in the book "JFK: The Case for Conspiracy" in which the authors claim the chin has been transplanted.









FIGURE RIT 12-2.—Enlarged copies of the three views of Oswald for comparison with the preceding illustration. Above is CE-133A.

(477) All three of these prints have light shadows on both sides of the dark shadow under the lower lip, but print CE-133A also has some irregular dark spots in the area where the line appears in the book illustration. Such spots could be caused by any of various natural factors, the most probable of which are shadows caused by the slight but obvious change in expression in the mouth area, random clumpings of silver grains which are evident at this magnification throughout the picture, and a slight change in the angle of the head with respect to the Sun.

(478) In any event, the dark spots on our print do not conform to a smooth line which would be the effect with the conventional procedures used in making composite images. A line can also be seen on the forehead of this photograph (CE-133A) which does not appear in CE-133B nor in the book illustration. The picture that appears in the book was made with high-contrast film or paper, an appropriate procedure for some purposes but it produces a misleading effect here in that it exaggerates some details and eliminates others. Observe that the laugh lines running down and out from the sides of the nose, which are plainly visible on our normal contrast print, have disappeared in the book illustration. We are convinced that there is no fakery associated with the spots on the chin.

(479) 13. Are there any pictorial inconsistencies that suggest faking?

(480) Careful examination of the photographs with respect to lighting, perspective, sharpness, distortion, grain pattern, density, and contrast revealed no evidence of fakery. Examples of evidence of fakery concerning the lighting would be shadows in the wrong position in relation to the position of the Sun and the object casting the shadow, shadows that do not correspond in shape to that expected when shadows are projected onto another surface, shadows that do not appear as sharp as expected with direct sunlight, shadows that do not appear as dark as expected with the approximately 1:8 lighting ratio between the shadow and highlight sides of objects obtained in sunlight on a clear day, and shadows that do not respond to nearby reflecting surfaces. No such discrepancies are seen in any of the three photographs of Oswald. The darkness, shape, sharpness, and placement of the shadows appear to be correct.

(481) The effect of light being reflected from the white surfaces on the left can be seen in the shadow on that side of Oswald's neck, and the shadow of Oswald on the ground moves appropriately as he changes his position between each of the photographs. Tilting the camera slightly downward for view CE-133A where Oswald is holding the paper under his chin, produces the expected higher placement of the figure in the picture and the divergence of the vertical subject lines toward the top of the picture.

(482) Composite photographs made using a pasteup or montage technique can usually be detected as such unless the component parts are made under identical conditions and with great skill. Clues that commonly reveal fakery are mismatches of the density, contrast, sharpness, graininess, perspective, and lighting, and imperfect blending of the edges between the parts. No such clues can be found in these photographs. Furthermore, there is no disruption of the grain pattern across the boundary between the head and the body or between the head and the background so that any composite photograph involving the head would require using large original negatives and prints and then copying the composite image with the Oswald camera. This possibility is discussed in the response to question 22, but nothing in the negative of the three prints of Oswald was detected that appears inconsistent or suggests fakery.

(483) Additional questions related to statements by Mr. Malcolm Thompson in a BBC film and a manuscript identified as "Panorama—Kennedy, Project number 5348/5506" that is included in the appendix:



484) 14. Does the apparent bulge in the left edge of the post to the right of Oswald's head appear to be due to retouching or other alteration of the image in photograph number CE-133B?

485) What could be perceived as an indentation in the post in CE-133B is believed by the undersigned to be an illusion resulting from the location of a shadow of a branch or leaf along the left edge of the post. It follows that since the darker area to the left of the post is a shadow of the post on a white surface, a shadow falling on the white post would be similar in tone and could be seen as part of the background rather than as a shadow on the post. The shadows falling along the right edge of the post create a slight illusion that the right edge is not entirely straight either, even though the background to the right of the post is lighter in tone.

486) Careful examination of this area on enlarged prints reveals a narrow object, that could be either a wire or a bush branch, running from the edge of the building on the right, in front of the post, across the area in question, and continuing through the shadow area between the neck and the post (fig. RIT 14-1). Anyone skillful enough to retouch the area between the neck and the post, as claimed by Mr. Thompson, and include the just-detectable wire or branch, would have no difficulty in producing a straight line on the post.



FIGURE RIT 14-1A.—Enlargement of a section of view CE-133B which shows what appears to be a wire or branch running through the shadow area to the right of Oswald's neck which Mr. Thompson claimed had been added to the photograph, producing an irregularity in the left edge of the post.

[These overlaying transparencies can only be analyzed by studying them in a viewer. For this reason, they have been retained in committee files.]

FIGURE RIT 14-1B.—Enlarged transparency on high-contrast film for check of line running through shadow area to the right of Oswald's neck. (The original transparency provides the best detail when viewed by transmitted light.)

(487) 15. Are the backgrounds and shadows identical on any of the three different views (CE-133A, CE-133B, and CE-133C), thereby suggesting that different figures have been superimposed on different prints of a single background photograph?

(488) The speculation is either that someone started with a photograph of a backyard with no figure and added the three figures from other photographs, or that Oswald's head was added to three photographs of someone else standing in the backyard. The backgrounds are not identical, thereby ruling out the possibility that figures were added to three prints of a single photograph of the backyard. The differences include changes in the convergence of vertical subject lines (the posts, the boards in the fence, and the building on the right) with changes of camera tilt, changes in the area of the background included in the three views, and slight changes in the positions of shadows of some branches and leaves.

(489) 16. Is there evidence that part of the background could have been moved photographically to fill a gap created by adding a figure in a different pose to a background photograph?

(490) No such evidence can be detected. Since the figure moved to the viewer's left between views CE-133B and CE-133A, and moved closer to the fence between views CE-133A and CE-133C, major gaps would have been created around the entire periphery of the figures if the figures had been added as suggested. Even if it is assumed that photographs of Oswald's head have been added to photographs of someone else's body, the necessary retouching around the edges would be difficult to conceal from detection with high magnification.

(491) 17. Is there evidence that the shadows have been touched in? No. The shadows appear normal in shape, location, sharpness, and contrast. It would be especially difficult to maintain realistic detail in the shadows on the ground if the shadows were added. It is noted that the shadow moves an appropriate distance to the left as Oswald moves to the viewer's left from view CE-133B to view CE-133A, and when he moves closer to the fence in view CE-133C the shadow moves up onto the fence as expected. (The relative distances between Oswald and the fence can be determined by noting the position of his feet with respect to the shadows of the three overhead wires.)

(492) It is true that highly skilled artists can and have made paintings that appear photographic. There is no evidence, however, that this was done in this case. To add shadows having detail to a photograph requires not only darkening the appropriate area, but also changing the detail within the shadow so that it appears to be illuminated by diffuse illumination from the sky and surroundings rather than by the Sun. Therefore, the sharpness and position of the detailed shadows within the larger shadow area must be changed in sharpness and position. For example, there is a ridge at the top of the white wall behind Oswald that casts a shadow on the wall beneath it. Where the Sun

its the ridge the shadow is sharp and contrasty. Where the ridge is in the shadow of the post, the shadow has a less sharp edge and the contrast with the adjacent area is lower. A similar situation exists where Oswald's shadow falls on what appears to be a paper on the ground near the fence. The soft shadows on the paper within the head shadow on view CE-133B appear as would be appropriate if illuminated with diffuse light from the fence and sky.

493) 18. Is the size or position of the shadow of the gun in Oswald's right hand (view CE-133B) inconsistent with the position of the gun?

494) If the gun were held vertically with the butt on the hip, we would expect the shadow to be oriented in the same direction as the shadows of the legs. However, the barrel of the gun is tilted toward the left side of the picture and also toward the camera. Both of these changes have the effect of rotating the shadow of the gun in a counter-clockwise direction. The positions of the gun and the shadow are heretofore compatible.

495) 19. Is there evidence that Oswald's left arm and hand have been stuck on to another photograph in a physiologically inconsistent manner (view CE-133B)?

496) It is possible to experience an optical illusion whereby the small wedge of the bare upper arm that is visible between the bottom edge of the dark sleeve and the lower arm appears to be part of a horizontal limb attached to the rib cage. This is an illusion not unlike the illusion in view CE-133A that the post is sitting on or growing out of Oswald's head. It is just as easy to see the small wedge of the bare upper arm as being part of a vertical limb that is mostly enclosed in the shirt sleeve. Moreover, it is difficult to understand the purpose of making a composite image in this manner.

497) 20. Is the area between Oswald's neck and the post to the viewer's right (view CE-133B) too wide to be filled by a shadow of the post, thereby indicating retouching?

498) The ratio of the shadow width to the post width was calculated for view CE-133A, where both are clearly visible, and was found to be 1:1.07. Applying the same ratio to an enlarged print of view CE-133B, where the post is 24 millimeters wide, the calculated width of the partly concealed shadow is 22.4 millimeters. The measured distance between the neck and the post is 22 millimeters if the apparent indentation is included, and only 20 millimeters to the position of the straight left post edge. Therefore, the distance between the neck and the post is not too wide to be filled by a shadow of the post.

499) 21. Are the heads on any two of the three different views (CE-133A, CE-133B, and CE-133C) from a single original photograph?

500) One method of detecting differences between two photographs is to place them in a stereoscope so that the left eye sees one photograph and the right eye sees the other. If the two photographs are identical, the two images will fuse and the viewer will perceive a single image. If the photographs are not identical, the areas of disparity will not fuse and the viewer will perceive two separate images. When the three views of Oswald were viewed two at a time in a stereoscope, it became apparent that no two of the images were identical.



(501) The procedure used in the CBC film to demonstrate that the heads on two of the photographs of Oswald were identical was to superimpose enlarged monochrome color transparencies having different colors. The viewer was thereby led to believe that the transparencies registered exactly. In an effort to duplicate this demonstration, we made closeup copy negatives of the head areas in the three prints identified as CE-133A, CE-133B, and CE-133C. These negatives were enlarged to 8 x 10 inches to produce diapositive images on normal-contrast film and also on high-contrast film. Green and magenta positive images were then produced by contact printing.

(502) Superimposing the normal-contrast color images from the pairs of photographs as was done in the CBC film revealed that while this appears to be an elegant test, it is not very discriminating. The registration between the two images could be altered considerably before any color fringing became apparent in the facial features. An explanation for this registration tolerance is that the facial details that appear sharp on a small print are revealed to have unsharp edges when enlarged to this size due to the granular composition of the photographic image. A close examination of the superimposed images revealed a difference in the grain structure, but color differences were obvious at a normal viewing distance only in the large areas of disparity in the background and under the head (fig. RIT 21-1).

[These overlaying transparencies can only be analyzed by studying them in a viewer. For this reason, they have been retained in committee files.]

FIGURE RIT 21-1A.—Superimposed normal-contrast green and magenta transparencies of pairs of the three views of Oswald reveal obvious color differences only in the large areas of disparity in the background and under the head. This is the procedure used in a CBC film to demonstrate that the heads on the photographs are identical. Above, CE-133A and CE-133B. (The original transparencies should be viewed by transmitted light. They are on file in the National Archives.)

FIGURE RIT 21-1B.—CE-133B and CE-133C.

FIGURE RIT 21-1C.—CE-133A and CE-133C.

FIGURE RIT 21-1D.—Both the green and the magenta transparencies were made from CE-133A to demonstrate that no color differences are seen even in the background with identical images.

(503) Two additional procedures were then used in an effort to verify and then provide evidence that the heads on the three photographs are not identical. For one, positive and negative high-contrast film images were sandwiched together and contact printed onto paper. When the positive and negative images are from the same original photograph (CE-133B) a fine-line effect is produced as shown in figure RIT 21-2. When the positive image from CE-133B is combined with the negative image from CE-133A, the areas of disparity are represented either as broader black areas or as broken lines. This print is shown in figure RIT 21-3. Similar comparisons of CE-133A and CE-133C, and of CE-133B and CE-133C are shown in figure RIT 21-4 A and B.

(504) It should be mentioned here that the head sizes were not identical on the original prints from the Archives. An adjustment was made when the copy negatives were enlarged to make the 8 x 10 inch diapositives. The widths of the images were matched at the temples and cheekbones, but the vertical-horizontal proportions are noticeably different. We attribute this change in the shape of Oswald's head to the downward tilt of the camera for photograph CE-133A, that placed the head farther off the lens axis. This effect is explained in greater detail below.

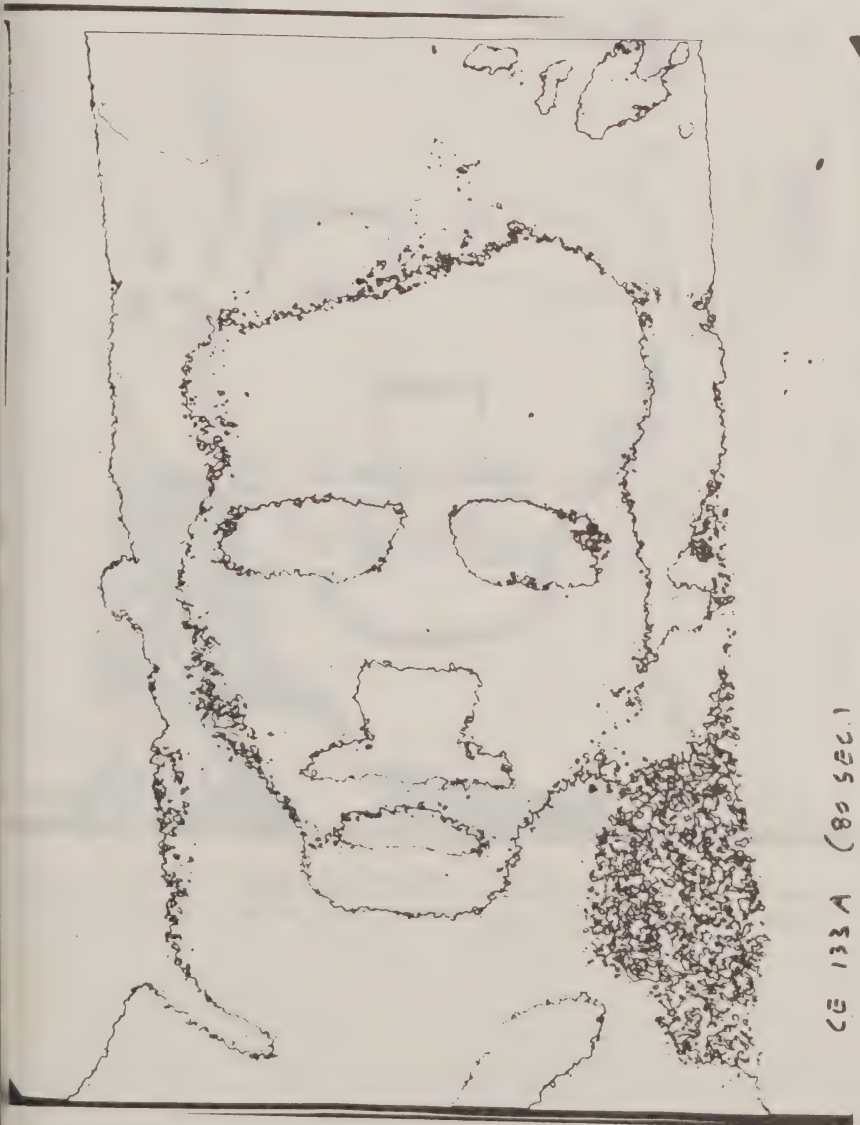


FIGURE RIT 21-2.—Print made from superimposed high-contrast positive and negative film images of view CE-133B to demonstrate that a fine-line effect is produced when the high-contrast images are made from the same original.

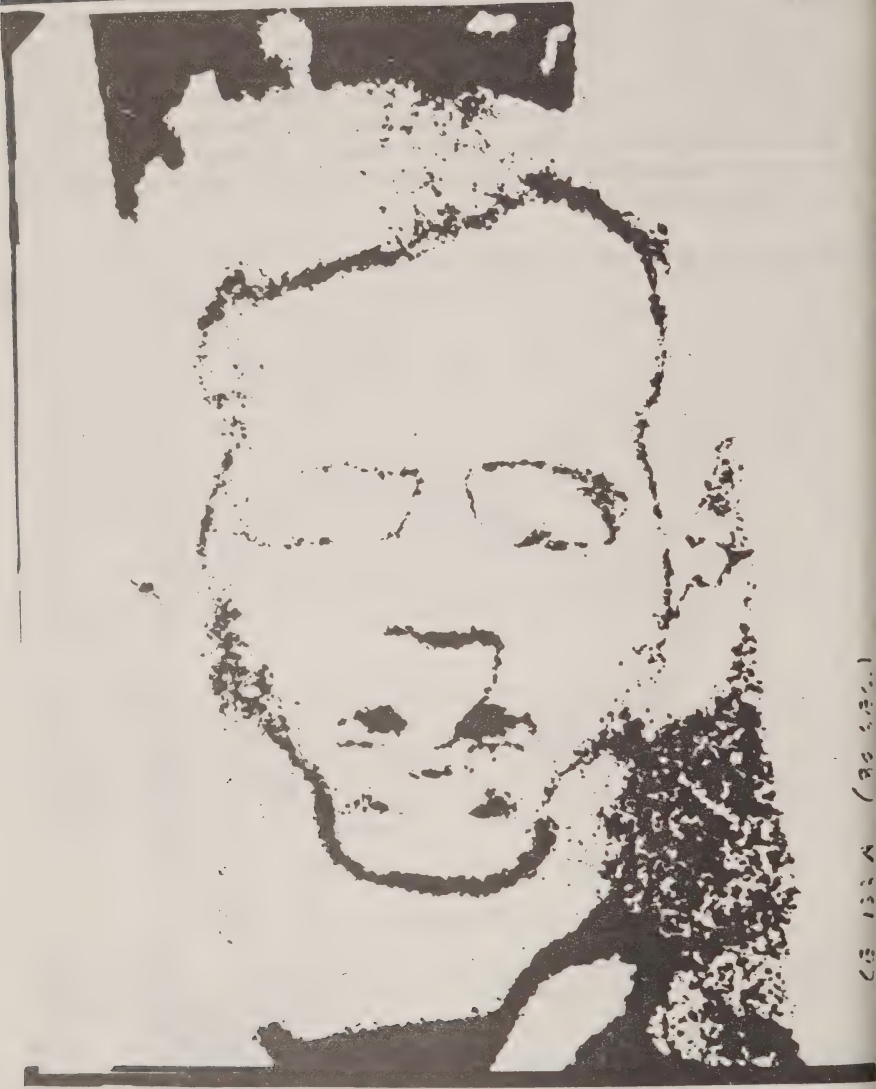


FIGURE RIT 21-3.—Comparison of CE-133A and CE-133B. The areas of disparity are represented either as broader black areas or as broken lines.



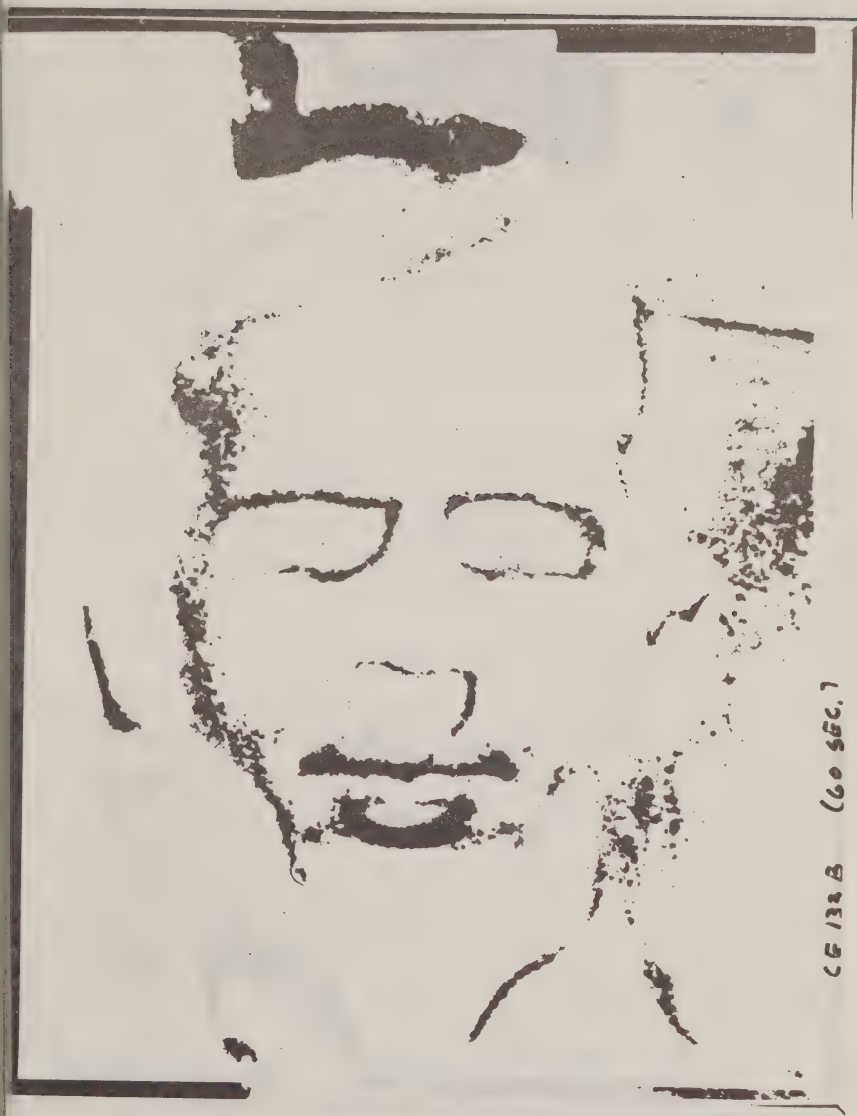


FIGURE RIT 21-4A.—Comparison of CE-133A and CE-133C.

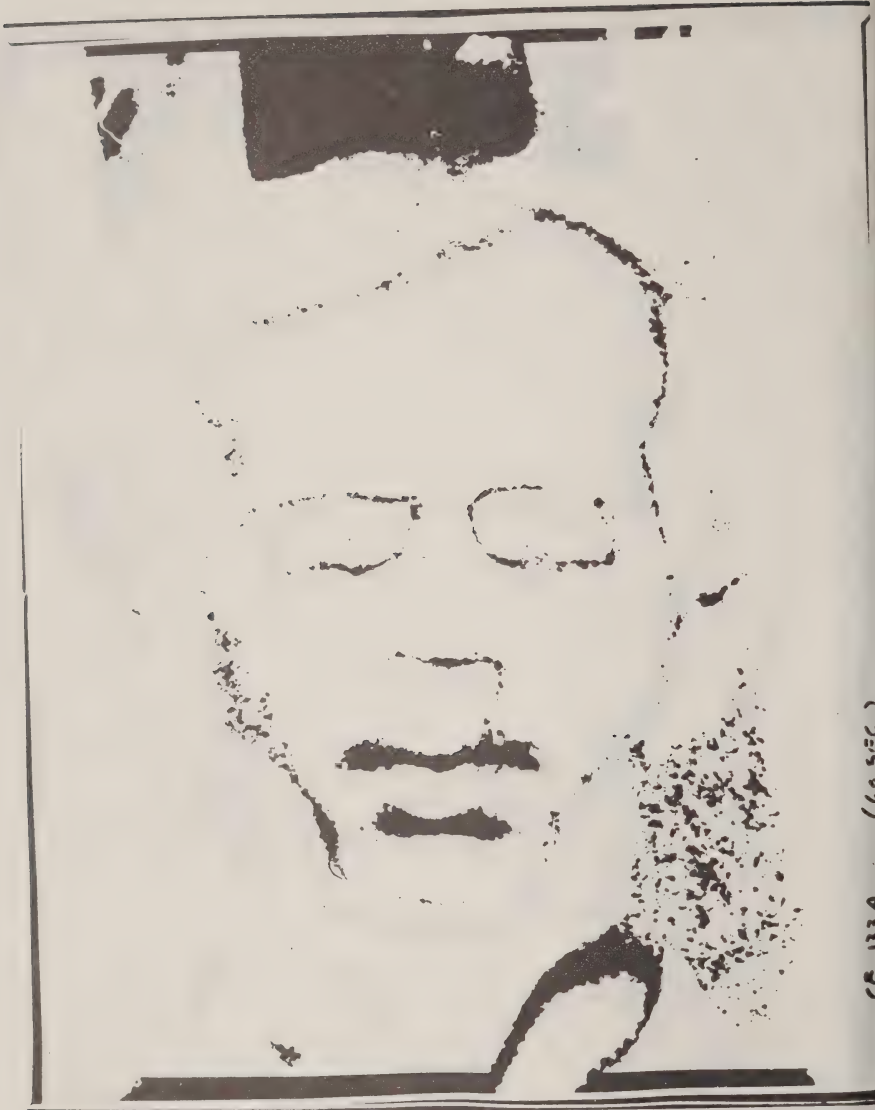


FIGURE RIT 21-4B.—Comparison of CE-133B and CE-133C.

(505) In addition to the change in the outline shape of the head, the disparity between the images in the area of the nose, mouth, and shadow under the mouth is quite obvious. We attribute these differences to a slight change in expression around the mouth and a slightly different angle of the head with respect to the Sun and the camera. The chin shadow appears in the shape of an inverted "U" in CE-133B and an upright "U" in CE-133A.

(506) For the third and final procedure demonstrating that the heads on the three photographs are not identical, green and magenta transparencies were made from the positive and negative high-contrast film images. When the green image from CE-133B is properly registered

(i.e., superimposed) on the magenta image from CE-133A and the two are opposite in negative-positive polarity (i.e., one is a negative image and the other is a positive image), the areas of disparity become evident as clear areas and as areas of a darker color produced by the overlap of green and magenta. We believe the differences are dramatic and clearly indicate that the two heads did not come from a single original photograph. This pair of images is shown in figure RIT 21-5. Similar results were obtained when high-contrast color images from view CE-133C were superimposed on those from views CE-133A and CE-133B (fig. RIT 21-6). An additional pair of green and magenta transparencies, both made from view CE-133B, is included to show the appearance of identical images in figure RIT 21-7.

[These overlaying transparencies can only be analyzed by studying them in a viewer. For this reason, they have been retained in committee files.]

Figure RIT 21-5.—When a green negative high-contrast image from CE-133B is superimposed on a magenta positive high-contrast image from CE-133A, the areas of disparity become evident as clear areas and as areas of a darker color produced by the overlap of green and magenta. (The original color transparencies should be viewed by transmitted light.)

Figure RIT 21-6A.—Superimposed high-contrast color images from CE-133B and CE-133C.

Figure RIT 21-6B.—Superimposed high-contrast color images from CE-133A and CE-133C.

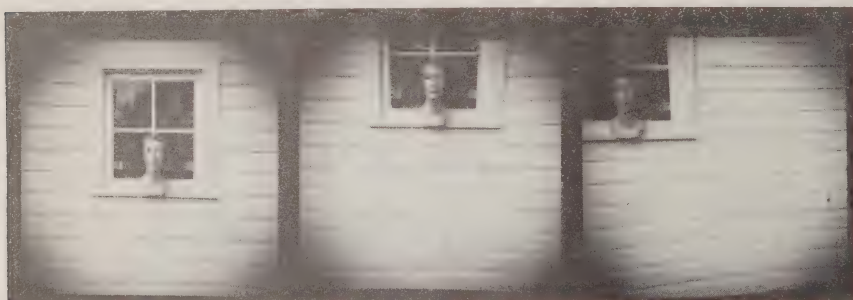
Figure RIT 21-7.—Superimposed high-contrast color images, both from CE-133B, to illustrate the effect obtained with identical original images.

507) Additionally, photographs were made of a manikin head with an Imperial Deluxe Reflex duo lens camera similar to the Oswald camera, placing the image of the head in various positions from the center of the negative to the edges. The purpose of this was to illustrate the effect such variations in placement have on the shape of the image of the head in order to explain the differences in head shapes in photographs CE-133A, CE-133B, and CE-133C, observed when the high-contrast color transparencies were superimposed. A black-and-white contact print of three negatives (fig. RIT 21-8) shows the manikin head in the center of the photograph, near the top (tilting the camera down), and near the top left corner (tilting the camera down and aiming it to the right). Placing the image of the head off the lens axis causes it to be elongated in a direction radiating away from the center of the photograph. Thus, the head at the top of the photograph is stretched vertically and the head in the corner is stretched diagonally. This change in shape can be seen on the contact print, but the heads were also enlarged on high-contrast film and contact color transparencies were made so that direct comparisons could be made by superimposing green and magenta pairs of the three images (fig. RIT 21-9).

508) This change in shape is known as the wide-angle effect and it occurs with all conventional camera lenses including normal, wide-angle, and telephoto, but it is most obvious with short focal length wide-angle lenses. In addition, pincushion distortion, which is evident in the curved reproduction of straight subject lines, and the altered



perspective, which is evident in the convergence of vertical subject lines when the camera is tilted, slightly affect the shape of the head. (The differences in sharpness of the images of the manikin head when placed in the center and near the edges of the photograph is further evidence of curvature of field observed in photographs made with the Oswald camera.) Thus, the difference in height to width proportions of the heads in CE-133A, CE-133B, and CE-133C can be explained in terms of these effects since the tilt of the camera changed between the photographs, thereby placing the head in different positions. Of the three effects mentioned, the wide-angle effect has the greatest influence on the shape of the head. Since the wide-angle effect applies only to three-dimensional objects, it would not alter the shape of a two-dimensional head on a photographic poster or print, the use of which has been suggested as a way of faking the photographs of Oswald. Thus, the presence of this effect in the backyard picture is another item of evidence negating the likelihood of fakery. (509) 22. Could the negative of Oswald be a copy of a composite print rather than an original photograph?



1. Image in center with camera level. Shape of head is normal.
2. Image at top with camera tilted down. Head is elongated vertically.
3. Image in corner with camera tilted down and rotated to the right. Head is elongated diagonally, away from the center.

[These overlaying transparencies can only be analyzed studying them in a viewer. For this reason, they have been retained in committee files.]

FIGURE RIT 21-8.—A contact print of three negatives made with an Imperial Reflex duo lens camera to show the effect of variations of image placement within the picture format on the shape of a head.

FIGURE RIT 21-9.—Enlarged high-contrast positive color transparencies of the three photographs in the preceding illustration, superimposed to reveal areas of disparity. (The original transparencies should be viewed by transmitted light.)



FIGURE RIT 22-1A.—An original photographic print that was copied with the Oswald camera to determine if the reproduction (following illustration) would be acceptable as an original photograph.



FIGURE RIT 22-1B.—A copy photograph made with the Oswald camera that has characteristics of an original photograph including the camera scratch pattern. The left border of the original print shows even though it was not visible in the camera viewfinder; the photograph also reveals exaggerated pincushion distortion due to use of a supplementary lens over the camera lens.

(510) The undersigned copied a photographic print with the Oswald camera, using a +4 diopter supplementary lens over the camera lens, to demonstrate that it is possible to make a copy negative that has characteristics of an original negative including edge markings, scratch patterns, variations in center to edge sharpness, pincushion distortion, and consistent grain patterns (fig. RIT 22-1 A and B). For this type of fakery to be successful, it would be necessary to use a large format camera with a good quality lens for the original photographs to avoid introducing graininess, scratches, unsharpness, or distortion at this stage. Also, any alterations would have to be made on large photographs so that retouching or discrepancies could be concealed. Furthermore, the Oswald camera would have to be available to the person making the fake photographs and it would be necessary to cal-



culate a combination of supplementary lens focal length and original print size to obtain an in-focus image of the desired size with the fixed-focus camera.

(511) Clues that might uncover this type of fakery would include strong pincushion distortion caused by adding a supplementary lens, loss of gradation in highlight areas and loss of detail in shadow areas which typically occurs when copies are made, and possible detection of imperfect retouching or other alterations. Pincushion distortion was much more evident on the copy photograph made with the Oswald camera than on the original negative of Oswald or on other photographs made with the Oswald camera without the supplementary lens. Since there is no wide-angle effect when two-dimensional photographs are copied, to avoid detection of fakery, appropriate variations in the shape of Oswald's head would have to be incorporated in the original photographs. In summary, it is possible to make copy photographs that are acceptable as originals. Nevertheless, because such a process poses many technical problems, any one of which if not solved would lead to detection under close examination of the photographs, we do not believe such a procedure was used to produce the three backyard photographs of Oswald.

#### ATTACHMENT A

##### GLOSSARY OF PHOTOGRAPHIC TERMS<sup>1</sup>

*Composite image.*—A photograph in which two or more separate images have been combined by any camera, printing, or post-printing technique—for example, camera montage, film stripping, printing montage, and pasteup.

*Contact printing.*—To expose photographic paper or other sensitized material through a negative or transparency while the two are pressed together for the purpose of making a reproduction that is the same size as the original.

*Contrast.*—The actual (objective) or the perceived (subjective) variation between two or more parts of an object or image with respect to any of various attributes such as luminance or hue. Subjective contrast is commonly described in general or relative terms such as high contrast or lower-than-normal contrast. Normal-contrast films generally represent luminance differences in the subject with corresponding density differences in the negative whereas high-contrast films record most of the subject tones as a uniform high density and a uniform low density.

*Copy negative.*—A negative produced by photographing a photograph as distinct from a negative produced by photographing an original scene.

*Curvature of field.*—A lens defect in which the sharpest image of a subject plane assumes the shape of a curved surface rather than conforming to the flat surface of the photographic film or paper. If a lens with this defect is focused in the center of the film or paper the image will be out of focus in the corners, and if it is focused in the corners the image will be out of focus in the center.

<sup>1</sup> The illustrations and some of the definitions are from *Dictionary of Contemporary Photography*, Leslie Stroebel & Hollis N. Todd, Dobbs Ferry, N.Y.: Morgan & Morgan, 1974, with the permission of the authors and the publisher.

*Density.*—A logarithmic measure of the light-absorbing characteristics of an image, filter, et cetera. (Perceptually, there is an inverse relationship between density of various areas in a photograph and perceived lightness, so that a shadow area that has high density is perceived as having low lightness.)

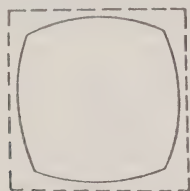
*Depth of field.*—The range of object distances within which objects are imaged with acceptable sharpness, for example, on a photographic print or transparency. Depth of field increases as the object distance, viewing distance, and f-number increase, and as the focal length decreases.

*Diapositive.*—(1) A transparency intended to be viewed or projected by transmitted light. (2) A positive image on a transparent or translucent support, used as an intermediate step in forming the final image. For example, a diapositive is made from an original negative to produce one or more duplicate negatives.

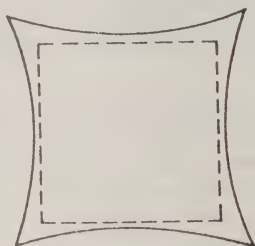
*Dimensional stability.*—The ability of film, paper, or other material to remain relatively unchanged in size when subjected to aging, processing, et cetera. Photographic papers may change dimensions by different amounts with the paper grain, and across the paper grain during processing.

*Diopter.*—A measure of lens power equal to the reciprocal of the focal length in meters. Plus and minus signs are used to denote positive and negative lenses, respectively. A +4 lens, for example, is a converging (positive) lens with a focal length of  $\frac{1}{4}$  meter or 250 mm. To a first approximation, the power of a lens combination is the sum of the powers of the components.

*Distortion.*—A lens condition that causes straight subject lines to bow inward or outward on the image (barrel distortion, pincushion distortion). This optical effect is caused by a variation of magnification across the field.



**Barrel  
Distortion**



**-Pincushion  
Distortion**

*Edge markings.*—Masking irregularities around the edge of the picture area on film exposed in a camera that correspond to irregularities in the film aperture in the camera.

*Film aperture.*—An opening in a plate, located close to the film plane of a camera or a projector, that delimits the area of illumination. The plate adjacent to the film aperture in a camera supports the film and prevents exposure of the film beyond the picture format.

*F number.*—A number, such as f/11, obtained by dividing the focal length of a lens by the effective aperture. The f-number and the shutter speed are two basic exposure controls in cameras.

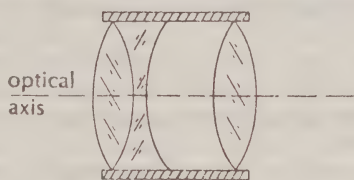
*Focal length.*—The distance from the rear nodal point of a lens to

he sharpest image of an object located at a very great distance on the lens axis. With camera lenses of normal design, the focal length is approximately the distance from the center of the lens to the film plane when the camera is focused on infinity.

*Gradation.*—A change in tone, texture, et cetera, between adjacent areas of an object or the corresponding image. Gradation provides the viewer with information concerning the form or depth of the subject, e.g., the facial features of a portrait subject as revealed by the lighting. **Synonym:** Local contrast.

*Grain.*—On black-and-white photographs, subject areas of uniform tone, such as blue sky, are composed of randomly distributed particles of silver. At low magnifications and large viewing distances the eye blends the small scale dark and light areas to produce a uniform tone. At high magnifications the nonuniformity can be seen as a clumping of the silver particles. The appearance of this clumping varies with number of factors including the type of film, the exposure level, and development.

*Lens axis.*—A line joining the centers of curvature of spherical surfaces and perpendicular to plane surfaces. With camera lenses, the lens axis can be approximated as a straight line perpendicular to the lensboard and through the center of the front surface of the lens. **Synonym:** Optical axis.



*Lensboard.*—A panel that supports the lens on photographic optical equipment. Lensboards are detachable on most view cameras and enlargers to permit the substitution of other lenses.

*Lighting.*—The character or quality of the illumination as seen in a subject or in a photograph or a motion picture. Included among lighting variables are placement of the light source and the resulting placement of highlights and shadows, uniformity of lighting, lighting ratio, and shadow sharpness.

*Lighting ratio.*—A factor obtained by dividing the illuminance on the highlight side of an object by the illuminance on the shadow side. A lighting ratio of 3 to 1 is commonly recommended for studio portraiture, whereas the lighting ratio for an object in direct sunlight is typically 8 to 1.

*Magenta.*—A hue (color) obtained by mixing red light and blue light, or by removing green from white light.

*Magnification.*—A scale of reproduction larger than one. An 8 x 10-inch print made from a 4 x 5-inch negative without cropping would have a magnification of 2.0, obtained by dividing an image (print) dimension by the corresponding object (negative) dimension. In some contexts magnification refers to the ratio of the image size on the print to the size of the object being photographed irrespective of the image size on the negative.



*Mask.*—A device to protect specific areas of photosensitive material from exposure. The mask on printing easels produces the white border on black-and-white prints and the panel around the film aperture in cameras masks the film around the picture.

*Negative.*—A photographic image in which the light subject tones are reproduced as dark, and dark subject tones are reproduced as light.

*Negative lens.*—A single-element lens that is thinner in the center than at the edges, or any lens that causes entering parallel rays of light to diverge. Negative lenses do not form real images, but they can be used in combination with positive lenses to form real images, where the combination will have a longer focal length than that of the positive lens alone.

*Perspective (linear).*—The representation of depth in a two-dimensional photograph by the convergence of parallel subject lines or the decrease in image size with increasing object distance. For example, train tracks converge and the distance between the two rails decreases in the photograph as the object distance increases.

*Pincushion distortion.*—An optical effect in which the magnification within a subject plane increases with distance from the lens axis, causing straight subject lines to be curved in the image. For example, the outside vertical edges of a building would curve away from each other at the top and bottom of the photograph. (See illustration under "Distortion.")

*Positive.*—A photographic image in which the tones are in approximately the same relationship as in the original, where light subject tones are reproduced as light tones and dark subject tones are reproduced as dark tones.

*Positive lens.*—A single-element lens that is thicker in the center than at the edges, or any lens that causes entering parallel rays of light to converge. Positive lenses can be used alone or in combination with positive or negative lenses to form real images. A combination of positive lenses will have a shorter focal length than that of any of the individual lenses.

*Projection printing.*—The use of an optical device containing a light source to project images of negatives or transparencies onto sensitized material for the purpose of making a print which may be larger than, smaller than, or the same size as the original. Commonly called enlarging.

*Resolution target.*—A design typically consisting of alternating light and dark lines that systematically vary in width, used to test the ability of one or more components of a photographic system, such as a lens, to image detail. Resolution is commonly expressed as lines per millimeter.

*Retouching.*—The technique of modifying a photographic image by manual methods of adding colorants, by abrading or bleaching the image, or by airbrushing. In portrait retouching of black-and-white negatives, for example, low density areas representing imperfections in the skin are darkened to match surrounding areas by adding graphite with a needle-sharp pencil.

*Scratches.*—Physical imperfections on a surface due to abrasion. For example, roll film can be scratched in a camera as it is advanced.

or rewound due to contact with irregularities in the camera film track or pressure plate, or the light trap in the film cassette.

*Sharpness.*—That subjective quality of an image associated with the distinctness of boundaries between adjacent objects. Acutance is the objective measure of edge quality that is related to sharpness. For example, a variation of sharpness in photographs is associated with camera focus and depth of field.

*Supplementary lens.*—A positive or negative lens that is added to the lens on a camera or other optical device for the purpose of changing the focal length. A positive supplementary lens decreases the focal length and a negative supplementary lens increases the focal length. Positive supplementary lenses are sometimes referred to as closeup lenses since they enable cameras to focus on shorter object distances.

*Transparency.*—An image (usually positive) intended to be viewed by light that passes through the image and the base by projection or on a transparency viewer, as distinct from reflection prints which are on a more or less opaque base and are viewed by reflected light.

*Wide-angle effect.*—A systematic change in shape of images of three-dimensional objects with angular displacement from the lens axis (that is, from the center to the edges of the film), most noticeable in photographs made with short focal length wide-angle lenses, where images of three-dimensional objects near the edges of the field of view appear to be stretched out of shape in directions radiating away from the center of the photograph. The effect is usually not apparent in photographs made with normal focal length lenses viewed at the correct distance because images near the edges are viewed at oblique angles that compress the images in proportion to the stretching that occurred when the images were formed by the camera lens. The image of a spherical object is widened about 10 percent at 25 degrees laterally off the lens axis and about 42 percent at 45 degrees off the lens axis.

## ATTACHMENT B

BRITISH BROADCASTING CORP.

*Lime Grove Studios, London, February 9, 1978.*

Representative RICHARDSON PREYER,  
House of Representatives,  
U.S. Capitol,  
Washington, D.C.

DEAR CONGRESSMAN PREYER: I wanted to send this transcript along to you immediately. We initiated a detailed analysis of the Oswald holding the rifle photos by Detective Superintendent Malcolm Thompson who ran the Police Forensic Science Laboratory Identification Bureau for 25 years. He is also an ex-president of the Evidence Photographers International Council and a fellow of the Institute of Incorporated Photographers, the Royal Photographic Society and the Institute of Professional Investigators. In short, he knows what he's talking about.

As you will see, he is sure that it is a fake photo—a montage of three separate pictures. Naturally, I'll be using him in our film, but I wanted your committee to have this information directly.

I'll be returning to New York on February 20, and we'll be having a prescreening in Washington sometime thereafter. We'll be in touch with your office to work out a convenient time and place for you and any committee or staff who might be interested.

My best,

DAVID OSTERLUND.

PANORAMA KENNEDY

ROLL 1A

INTERROGATOR. Mr. Thompson would these photographs be acceptable as evidence in a British court of law?

Mr. THOMPSON. No. I have examined these photographs and have established without doubt that there is retouching on them and it is a basic principle with a forensic photographer that he would never, never retouch a photograph in any form of litigation.

INTERROGATOR. What would happen in a British court of law if photographs like this were produced as evidence in a murder case?

Mr. THOMPSON. If they were produced in a murder case then the defending counsel without doubt would have an expert examine them and if retouching was found on them then they would not be included in the evidence.

INTERROGATOR. Are you saying that if photographs like this were produced in a British court of law in a case, they would be thrown out?

Mr. THOMPSON. I do. Yes. They would be thrown out.

INTERROGATOR. What leads you to feel that?

Mr. THOMPSON. Well primarily the retouching is very very obvious in certain parts of the picture but more in particular in a perpendicular pillar here which should be a straight line. When one comes to a point, the subjects chin, one finds that there is a bulge in a line. Without doubt that shows this area between the head and the pillar has been retouched and the retoucher has just not been careful enough to maintain the retouching he should which is within the pillar in what should be a shadow area. Now that is photograph B.

In photograph A we do see the pillar as a straight pillar, it is not as if the wood has a flaw at that point there. The flaw is created in photograph B due to the fact that the retouching has extended over onto the pillar.

INTERROGATOR. I wonder if you could go through the two photographs and list for me what you regard as the discrepancies in those photographs.

Mr. THOMPSON. The backgrounds are very very similar to the point that either the camera was on a tripod when the pictures were taken or we are speaking about a common negative having been used to produce the two backgrounds. They look dissimilar, there is a horizontal shift and a vertical shift in the two pictures but that purely and simply, I think, is meant to mislead the viewer.

When one measures the pictures, photograph A is enlarged slightly greater than photograph B but even allowing for that, the shadow detail in the static areas of the picture, that is in particular on the staircase here, the shadows are so exact that there is no doubt in my mind, it is either a common negative used to produce the two prints or two suc-



cessive negatives with the camera on a tripod and neither camera or tripod moved in any way between the two exposures.

There is a discrepancy up in this area here. At this point I can only assume that someone has cut out this area and changed its position slightly, it is fractional but in this picture here we see the horizontal part of the neighboring house with a highlight in this area, whereas in this picture here the horizontal part can be seen far below the section the angle caused by the upright pillar and the step. You can see a fractional difference there whereas in this picture the fractional difference does not exist.

Again with that if we take a dark triangle here between the roof of the house next door and the skyline then that d - - - angle finishes up level with the shadow of the staircase there and in the other picture the diagonal angle is below the shadow of the staircase. Similarly, the vine passing up through here is in a lower position at that point in that picture than it is in that picture.

I then come to the conclusion that part has been raised in photograph B and retouching done down here to fill up the small gap created. That is again borne out by the fact that here in photograph A the picture finishes up dark and in photograph B at that point the picture finishes up gray.

So much for the background. If we take the body. The body shadows don't relate to the other shadows in the picture and one can only come to the conclusion that this body has been placed in the background and photographed but all the shadows here are swinging to the left whereas this shadow is slightly to the left but also behind the body is common to both pictures but when one examines the shadow content, one sees the gun at an angle to the body which does not relate to the angle in the shadow. The gun is reaching far more out to the right, more in a horizontal position here in relation to the body shadow than the gun is actually being held by the person.

INTERROGATOR. So you think that those shadows have actually been touched in.

Mr. THOMPSON. They have been touched in.

Again, there is something peculiar about this hand. The entire hand and arm is very, very unnatural. It possibly could have been stuck in afterward; but I can't relate physiologically the position of that arm to the body.

The butt of the rifle I think is the telltale in this picture here where we see very, very little of the butt actually protruding beyond the trouser line and yet down here having been painted in is a very, very large butt, I say very large in relation to the length of the shadow and we can measure the length of that shadow in relation to the height of the person and measure off the butt of the gun as against the shadow of the butt and that is to me unnatural.

The head itself, I have seen photographs of Oswald and his chin is not square. He has a rounded chin. Having said that, the subject in this picture has a square chin but again it doesn't take any stretch of the imagination to appreciate that from the upper lip to the top of the head is Oswald and one can only conclude that Oswald's head has been stuck on to a chin, not being Oswald's chin.

Then to cover up the montage, retouching has been done both to the right, that is Oswald's right and Oswald's left and when we

consider this area of retouching here—compare it with what we see in photograph A we have a shadow cast by this wooden pillar. I have measured those and even allowing for the difference and degree of enlargement between photograph A and photograph B the area we see in shadow here is far in excess of what it should be and of course that is the area to which I referred earlier on where the pillar coming down does not continue in a straight line but has this bulge in it.

INTERROGATOR. Are there other things about the face itself which would make you suspicious?

Mr. THOMPSON. Yes, again we have a shadow underneath the nose. In photographs A and B you see Oswald's face in a different posture and yet the shadow under the nose hasn't moved or if it has moved it is only fractional compared with the actual movement we see in the face and one comes to the conclusion that it is the same picture used for both faces, possibly in this face here he has got a scowl on his face and there has been retouching done in the chin area which is what would expect if my conclusion is correct, that this face has been added on to the chin.

He has a very, very thick lower lip here which is not consistent with Oswald's lip and again the shadow underneath the lip is a horizontal shadow, that is consistent in both, even allowing for the fact that we have a slight tilt in the head of photograph B as against that in photograph A.

INTERROGATOR. Is it easy to make a photo montage like this?

Mr. THOMPSON. Yes; it is very, very common in the advertising world, professional photography, advertising photographers do montages all the time because it is the easiest way of obtaining the effect they want as against trying to set up that effect, it might be an impossible effect to set up, they have got to resort to a photo montage to do it.

#### 801 Take 1

INTERROGATOR. What about the arm?

Mr. THOMPSON. The arm in photograph B just doesn't look natural, in fact it looks as if it has been stuck on the body.

INTERROGATOR. How easy is it to make a photo montage like this, how would people go about it?

Mr. THOMPSON. It's not difficult. If one has a background scene, the subject photographed against a white background making it simpler to cut out the subject from the back.

INTERROGATOR. How do you think this photo montage was achieved?

Mr. THOMPSON. The montage could be achieved by a photograph of the background and a photograph of a body against a white background and having been cut away from that white background and then matted as we see it here and then being in possession of a photograph of Oswald's head, merely mounting that on to the top of the body, stuck down and touched in such a way that your lines are not going to be too cut and dried between the body and the background and then rephotographed on to a negative and then from that negative of course producing as many prints as you like and possibly rephotographing the print from the negative in order to soften down the background and that would develop each time the photograph was copied.



INTERROGATOR. Is that very easy to do?

Mr. THOMPSON. It is not difficult at all, don't ask me to do it, I am a forensic photographer. The last thing I would do is to retouch or indulge in any form of montage. My duty would be to present to the court what I know about the case and illustrate what I know about it in straightforward photography but there are retouchers in many facets of professional photography, they do resort to photo montages, in particular the advertising profession.

INTERROGATOR. Would the investigator agencies in America like the FBI and the CIA have that sort of professional expertise themselves?

Mr. THOMPSON. I would hope they don't have it because it is not part of their duties as forensic photographers to produce anything in court which has been retouched.

INTERROGATOR. Yes; but regardless of your hopes, I am asking whether you believe that the professional agencies in America have that sort of photographic expertise?

Mr. THOMPSON. I wouldn't think they have it but most certainly it wouldn't be difficult to get access to it. Every moderate studio in America has its retoucher in the same way as the biggest studios in Britain have their retoucher but in America you do have photographic artists, a profession all to itself, and they are spread all throughout the United States, access to one of those persons, its mostly ladies who do it and do an extremely good job in producing from a black and white picture, anything from anything as far as an oil painting from photographs.

INTERROGATOR. How quickly could you make a photographic montage like that?

Mr. THOMPSON. I would guess and say that you need at least 4 hours to produce it and that is working hard and possibly a team working at it, not just one man but I have no personal experience of how long it takes.

INTERROGATOR. Would you be prepared to produce yourself those photographs as evidence in court?

Mr. THOMPSON. After having examined them definitely not. I couldn't resort to producing anything in court which was other than just the original print from the original negative, even to the point if there was a flaw in the negative I'd be prepared to leave that in the final enlargement for the court purposes. If I was asked during the trial or the hearing then I could explain away quite simply as it being a flaw in the negative and possibly have the negative there as evidence. There is no need to retouch anything in a forensic photograph and certainly in Britain forensic photographers would just not retouch anything.

INTERROGATOR. Do you believe that those photographs are a fake?

Mr. THOMPSON. I think they are a fake and possibly the shadow detail and its relation to the static scene and the body are the giveaway, plus the fact there is retouching in sufficient salient places to make one appreciate that something peculiar has gone in relation to the head and the body and the areas surrounding it.

INTERROGATOR. Can you describe what your method was in order to try and determine that it was a fake?

Mr. THOMPSON. One measures the pictures first to ascertain the degree of enlargement, there is no use comparing distances on a picture



unless you are certain that the two pictures you are comparing are of the same degree of enlargement. In this case they weren't of the same degree of enlargement and that created slight difficulty in relating one subject to another.

After having done that a very close examination of the fine detail present in the pictures brought me to my conclusion.

INTERROGATOR. Was your method to look for discrepancies?

Mr. THOMPSON. Exactly, that has been my life's work looking for the unusual and comparing one thing with another to see similarities or dissimilarities and what in general has been your conclusion in looking at those two photographs.

In general I have come to the conclusion that we have a montage of three pictures to make one end product as we see it here today.

INTERROGATOR. Does it strike you as strange that the police did not find those photographs, despite an intensive search on the day of the assassination and only found them the next day.

Well searches of premises are always difficult things, to carry out one has got to be systematic, there is only one way to carry out a proper search of a scene of crime or any other premises which might be of interest to the police and that is there are two officers doing it and one officer systematically follows round doubling what the other officer has done and in that way then two pairs of eyes should be better than one pair and nothing of importance should be missed.

So does it strike you as strange that in their search, after all connected with the assassination of a president that they should find such damning evidence the next day?

Mr. THOMPSON. It does, it does seem unusual. One would think that the officers involved would be highly experienced officers, would know and have been trained to carry out the search of premises.

INTERROGATOR. Is there any possibility in your mind that those two photographs are genuine?

Mr. THOMPSON. I don't think there is any possibility, having examined them for a considerable time it is my considered opinion that they are not genuine.

INTERROGATOR. Thank you very much.

ROLL 2A

802 Take 1

INTERROGATOR. After examining these photographs what is your professional opinion on them?

MAN. My opinion is those photographs are faked.

INTERROGATOR. What makes you think that?

MAN. The amount of retouching that is done and possibly more in particular the relationship between the shadows of the background and the shadows in the front of the body in the picture.

INTERROGATOR. Would you ever be prepared to produce those photographs in a British court of law.

MAN. No. I certainly would never contemplate using pictures which had been retouched or spotted in any way in a court of law. My task would be purely and simply to illustrate the evidence I was giving by straightforward photography. Any blemishes in my pictures then most certainly I would leave them in there and finish the enlargements

nd be able to explain to the court what exactly had happened, have no negative in my pocket as a protection if necessary. There is no need to spot pictures and forensic photographers in this country will just not resort to any form of retouching of any picture.

INTERROGATOR. Is there any possibility in your view that those photographs are genuine?

MAN. There is no possibility in my view that they are genuine, they have been retouched and I consider the picture to be the result of a montage.

INTERROGATOR. Thank you.

## 2. AUTHENTICATION OF THE KENNEDY AUTOPSY PHOTOGRAPHS AND X-RAYS

### (a) *Introduction*

512) Authentication of the autopsy photographs allegedly taken of President Kennedy was considered essential because of the discrepant descriptions that have been given of the wounds incurred by the President. The description of the size and location of the President's head wounds, for example, by eyewitnesses at Parkland Hospital differed dramatically from the testimony of the autopsy doctors and the account set forth in the Warren Report. (195) More recently, the panel of medical experts convened by then-Acting Attorney General Ramsey Clark described Kennedy's head entrance wound as approximately 10 centimeters higher than the location reported by the Warren Commission. (196) As a result of these discrepancies, it was essential to verify that the autopsy photographs and X-rays did, in fact, depict Kennedy, and that these materials had not been altered in any way.

### (b) *Issues*

513) 1. Do the postmortem photographs and X-rays in the custody of the National Archives purporting to depict President Kennedy, in fact, depict him?

514) 2. Is there any evidence that either President Kennedy's autopsy photographs or X-rays have been altered?

### (c) *Materials examined*

515) Twenty-seven original color transparencies and the twenty-five original black and white negatives were examined. These depicted the subject's head and upper torso from various positions.\* In addition, 8" x 10" color and black and white photographic prints generated from these transparencies were evaluated.

516) The X-ray materials consisted of the following items:

517) 1. An attempted anteroposterior projection of a skull identified as:

21296 (numbers upside down).

U.S. Naval Hospital.

NNMC Bethesda, Md.

November 22, 1963.

\*A more detailed description of these photographs is provided in pars. 570-571, 583-595 *infra*.

- (518) 2. Right lateral projection of a skull with the same identification symbols.
- (519) 3. Left lateral projection of a skull with the same identification symbols.
- (520) 4. Three radiographs of three fragments of bone unidentified by symbols.
- (521) 5. An anteroposterior projection of a chest with the same identification symbols as Nos. 1–3 above. This radiograph was obtained with the thoracic cage intact, that is, before autopsy.
- (522) 6. An anteroposterior projection of a chest with the same identification as No. 5 above. This radiograph was obtained after the thorax had been opened and the lungs and mediastinal contents had been removed.

#### (d) *Procedures*

- (523) Independent of the panel's analysis, the photographs and X-rays were reviewed by the three physicians who performed the autopsy, the leader of the X-ray team that took the postmortem X-rays, and by the photographer who took the autopsy pictures. These individuals indicated that the photographs and X-rays accurately portrayed Kennedy's various wounds. (197).
- (524) The panel's board of consulting forensic anthropologists and a forensic odontologist compared the photographs and X-rays with premortem photographs and X-rays of Kennedy. Premortem materials were studied for the purpose of discerning unique anatomic features whose presence in the postmortem photographs and X-rays would verify that the individual depicted was, in fact, Kennedy.
- (525) The photographic materials and X-rays were examined visually by the panel.<sup>1</sup> This review included both microscopic examination and viewing relevant photographs in a stereoscope, a special device that allows pairs of photographs to be viewed in three dimensions. Because stereoscopy provides an excellent means by which altered or doctored photographs can be detected,<sup>2</sup> primary reliance was placed upon this analytical technique.<sup>3</sup>
- (526) Finally, the autopsy X-rays, in addition to being reviewed by the panel, were analyzed for evidence of fakery by a radiologist who had particular expertise in the area of image enhancement.

#### (e) *Conclusion*

- (527) 1. The postmortem photographs and X-rays in the custody of the National Archives purporting to depict Kennedy do, in fact, depict him.

<sup>1</sup> Because the Department of Defense was unable to locate the camera and lens that were used to take these photographs, the panel was unable to engage in an analysis similar to the one undertaken with the Oswald backyard pictures that was designed to determine whether a particular camera in issue had been used to take the photographs that were the subject of inquiry.

<sup>2</sup> The principle of stereoscopy is discussed in detail in pars. 75–79, 434–36 supra.

<sup>3</sup> While several of the autopsy photographs and X-rays were enhanced through the use of digital image processing, the resulting enhanced photographs and X-rays were used exclusively by the autopsy panel for determining the nature and cause of wounds. They were found to be unnecessary in the analysis to detect possible fakery, since the original materials, when viewed stereoscopically, were of sufficient quality to resolve this issue.



(528) 2. There is no evidence that either the Kennedy autopsy photographs or X-rays have been altered.

(f) *Analysis*

(529) This section will deal primarily with the panel's visual examination. Separate reports have been filed setting forth the detailed analysis of the panel's board of consulting forensic anthropologists and the forensic odontologist.

(530) Visual inspection of the autopsy photographs and transparencies revealed no evidence of retouching, compositing, or other evidence of fakery. Because all of the relevant photographs were studied stereoscopically, it is extremely unlikely that evidence of fakery would have escaped detection.

(531) Stereoscopic viewing is made possible when two photographs of a subject are taken from a slightly different position in space (that is, a few centimeter movement of the camera or a similar degree of movement by the subject photographed). This was made possible in the present case because the autopsy photographer, in an apparent effort to insure a good final result, took two or more pictures of each relevant view.

(532) Because pairs of stereo pictures may be seen in three dimensions, such photographs add depth to the perception of the photographed scene in much the same way as a pair of human eyes, separated from one another in space, can perceive depth.

In viewing stereo pairs of photographs through a stereoscope, one eye views one picture and the other eye views the second picture. As a result, the eyes, coupled with the visual image processes of the brain, are able very readily to perceive any differences between the two pictures. Such differences in the scene between the two pictures tend literally to "pop out at you." No differences of this kind were observed by the panel in stereo pairs depicting the back of Kennedy's head, the top of his head, the large skull defect, the right front of the head, the back wound or the anterior neck wound. In this way, photographs of each of Kennedy's wounds were effectively authenticated.

(533) It is theoretically possible to alter photographs that comprise a stereo pair. To avoid detection of such alteration, however, requires that each picture comprising the pair be altered slightly different, in a systematic way. This is extremely difficult because each picture of a stereo pair is a picture of the scene from a slightly different but directly comparable, point of view. Such alteration is virtually impossible when, as in the case of Kennedy's head, the image photographed contains considerable detail.

(534) The examination of the postmortem X-rays focused primarily on the following possible indicia of fakery:

- (1) observation of a difference in density of the images;
- (2) discontinuity of anatomical structures;
- (3) alteration of continuity of an abnormal pattern; or
- (4) production of an image which is not anatomical or an image of an impossible pathologic process.

(535) No such evidence of fakery was discerned. (198) The X-ray images have not been altered in any fashion except for:

(536) 1. Two small areas of thermal damage resulting from a light source that was once held too close to the "anteroposterior" image. These were reported to be present on an observation report dated November 1, 1966, and validated by signature November 10, 1966. This report is in the National Archives.

(537) 2. In addition, the panel observed minor "staining" or discoloration of the images due to incomplete processing of the film in the developing process. This discoloration will continue to be more prominent with the passage of time. (199)

(538) Finally, the linear opacities associated with the postmortem X-rays have been said to be the result of manipulation. These opacities are normal grid lines from the grid used to eliminate "scatter fogging" of the images at the time of exposure of the films, and, therefore, represent normal images rather than evidence of manipulation.

### 3. FORENSIC ANTHROPOLOGICAL ISSUES

#### (a) *Introductory statement of approach*

(539) In the course of its investigation of the death of President Kennedy, the committee encountered several problems concerning the photographic identification of certain individuals either known or alleged to have been involved in the assassination. Upon the advice of other scientific consultants, it was determined that some of these problems fall within the purview of forensic anthropology, a relatively new discipline of the forensic sciences.

(540) Forensic anthropology is defined as the application of the physical anthropologist's knowledge of human variation to problems of legal medicine. As implied in this definition, forensic anthropologists, of whom there are fewer than 30 in the United States, are physical anthropologists who, by training and experience, are qualified experts in the medicolegal aspects of their science. The parent field, physical anthropology, is the study of man's biological variation in space and time. Any physical or physiological difference between human individuals and populations is of interest to physical anthropologists. Applications of their expertise range from the search and study of man's remotest fossil ancestors to helping design space suits for astronauts.

(541) For over a century physical anthropologists have measured the distances between specific anatomical landmarks of the human body in order to describe mathematically its variation in size and shape. To minimize error and insure repeatability, the measurements are made by trained anthropometrists with the subject positioned in a standardized pose. Size differences in body dimensions are reflected in the measurements themselves. Shape differences are defined by simple indices or by more complex multivariate methods. An index is ordinarily computed by dividing the smaller of two measurements by the larger and multiplying the result by 100 to eliminate the decimal. For example, the nasal index is computed as follows:

$$\text{Nasal Index} = \frac{\text{nose width}}{\text{nose length}} \times 100$$



From this, it can be seen that the nasal index provides some numerically expressed information about the shape of a given individual's nose. In a person with a short, broad nose, the index will be larger than in one whose nose is long and narrow.

(542) Although measurements are usually taken on living subjects; techniques to obtain accurate anthropometric measurements from photographs have also been developed. Nevertheless, such methods require elaborate equipment and extremely close control of the subject's pose, lighting, lens-subject distance, and other technical factors. Photogrammetric anthropometry generally also requires that the anatomical landmarks be marked on the subject in advance so that the distance between these points can be measured on the photograph.

(543) From time to time, forensic anthropologists are also asked to compare one or more photographs of crime suspects, disaster victims, or other unidentified persons to establish their identification. Usually, the photographs submitted for examination consist of casual snapshots, press photographs, studio portraits, passport pictures, or police "mug shots." Naturally, such photographs vary greatly in enlargement, camera angle, image clarity, lens-subject distance, lighting, and other factors that make direct comparison of measurements taken from such disparate photographs extremely difficult or totally impractical. For instance, an individual's nose width and length measured from a wallet-size identification photograph and a large studio portrait will be greatly different. Unless we know the exact degree of enlargement, type of camera, lens-subject distance, and many other technical features involved in making both photographs, meaningful comparison cannot be made between the nasal dimensions of the individual in terms of absolute size. Unfortunately, this kind of information is usually lacking on the types of photographs submitted for identification. In short, size differences cannot usually be studied in such analyses.

(544) Nevertheless, if two photographs are reasonably similar in camera angle—let us say, full-face—the ratio of nose width to length will be the same, or nearly so, in both photographs. Consequently, the nasal index, as defined above, can still be determined and meaningfully compared. This of course does not necessarily mean that the value of the index will be precisely the same from photograph to photograph of the same individual. Small variations in camera angle, lighting, facial expression of the subject, and measuring technique will introduce corresponding errors in the nose width and length measurements taken from the photograph, and these will be reflected as corresponding variations in the index values. Nonetheless, it is reasonable to expect the varying index values of the same individual to cluster within a reasonably narrow range.

(545) Of course, one does not rely upon a single index. Along with nasal width and length, a number of other facial measurements can be accurately taken from suitable photographs and pairs of these can be combined to produce other indices which describe other features of facial shape. Angles are also independent of enlargement factors and can be used for comparison. For example, from profile photographs one can measure the angle between the nasal bridge and the general facial plane and, in the same individual, it will be found to be fairly constant from one photograph to another. Thus, instead of only one or two indices or angles, several can be employed to add reliability to the com-



parisons. The term metric analysis is used to refer to comparisons based on numerically expressed variables such as angles and indices.

(546) The use of indices of this kind has not been refined to such an extent that a particular numerical result may automatically be considered indicative of a strong resemblance between two individuals, or that the same individual is, in fact, the subject involved in each case. Nevertheless, for general guideline purposes a mean deviation of five or less between the cumulative indices may be considered indicative of a strong physical resemblance.

(547) In addition to the analysis of metric traits by the use of such indices, there are certain other facial features which, although they cannot be conveniently measured or expressed numerically, are nevertheless very useful in photographic comparisons. This group of features vary considerably, but collectively can be called morphological (as opposed to metric) traits.

(548) An example of such a trait is the lowly ear lobe which, aside from providing a convenient place to hang earrings, seems to have no discernible purpose except to provide physical anthropologists with something to classify. Accordingly, a threefold classification of ear lobes as either free, attached, or soldered has been devised. Free lobes are those that are to some degree pendulous; in attached lobes the outside margins of the ears connect more or less directly to the side of the face. The soldered lobe is an extreme form of the attached type in which union of ear margin and cheek is so direct that there is no discernible lobe at all. Since ear lobe type can frequently be determined from photographs, the trait can be useful in identification.

(549) In addition to lobe type, there are numerous other structural features of the human ear that vary considerably from one person to the next. The total complex of these traits, while not as individually distinctive as fingerprints, are sufficiently unique to permit identification beyond reasonable doubt in many cases.

(550) Along with ears, the human face possesses an array of morphological features that, while difficult to measure, can be readily classified. The nasal tip can be elevated ("snub-nosed") or depressed, pointed or bulbous; the bridge of the nose, in profile, can be straight, convex or concave. Lips can be thick or thin; hair—straight, wavy, curly, or kinky, and so on. Also within this category are traits that are acquired by accident or age (or as Shakespeare put it ". . . through chance or nature's changing course untrimmed"). Among traits acquired during life may be included warts, moles, and other random blemishes, scars from accidents or surgery, broken noses, cauliflower ears, and other more or less permanent disfigurements. The inevitable loss of skin elasticity with age produces wrinkles and these networks of creases and furrows form patterns that uniquely characterize each human face. The comparison of traits that cannot be measured but only classified (as the ear lobe) or described as "present" or "absent" (such as a scar) constitutes the morphological analysis of the photographs in question.

(551) The forensic anthropologists serving as committee consultants were asked to deal with five specific problems of photographic identification:

(552) 1. *Authentication of JFK autopsy photographs and X-rays.*—Certain conspiracy theorists have claimed that the autopsy

photographs and X-rays are of a person other than the President. Is there scientific evidence that will support or refute this claim?

(553) 2. *The Milteer issue*.—Whether a certain man photographed in the line of motorcade spectators was actually one Joseph A. Milteer? Milteer (now dead) was a militant right wing activist who has been alleged to have had knowledge of a plot to assassinate President Kennedy.

(554) 3. *The three tramps issue*.—Shortly after the assassination, three men, described as derelicts, were apprehended by Dallas County Sheriff's officers in a boxcar on the triple overpass overlooking Dealey Plaza. These men were released without being formally identified. Could any of these men be certain individuals who some conspiracy theorists claim were involved in an assassination plot?

(555) 4. *The "Second Oswald" issue*.—Several assassination theories have been based on the speculation that Lee Harvey Oswald may, at one stage or another, have been impersonated by a double. Do the known photographs of Oswald support or refute this hypothesis?

(556) 5. *The Lovelady issue*.—Photographs taken during the assassination show a man standing in the doorway of the Texas Schoolbook Depository who bears a striking resemblance to Lee Harvey Oswald. Was this man actually Oswald or another Depository employee, Billy N. Lovelady?

(557) A review of the issues stated above shows that they were diverse in scope and therefore required an equally diverse approach in their resolution. Nevertheless, certain steps and procedures that were common to all may be briefly outlined here.

(558) 1. *Selection of materials*.—An initial step in all cases was a review of the available photographic materials and selection of those technically suitable for analysis. In some cases the selection was extremely limited. For example, because only one photograph of the spectator alleged to be Milteer was suitable for analysis, all comparisons with known photographs of Milteer had to be made against this single item. At the other extreme, dozens of photographs of Lee Harvey Oswald ranging in time from his Marine Corps enlistment to his arrest in Dallas were available for study.

(559) 2. *Measurements*.—Selected photographs were next processed for measurement. In some cases, measurements were taken from the unenlarged original photographs with a Bausch and Lomb measuring magnifier equipped with a calibrated metric scale. In others, measurements were taken from enlargements (made, when possible, from the original negatives) to the nearest 1.0 mm. All measurements were taken by one observer. Measurements reported here represent the mean of three trials.

(560) 3. *Computations*.—As noted previously, since enlargement factors were unknown, size differences—as represented by the raw measurements taken from the photographs—could not be meaningfully compared. Instead, indices were calculated between related measurement pairs. Wherever possible, landmarks, measurements and indices were selected that corresponded to those long standardized by physical anthropologists for facial anthropometry. Not all measurements could be taken from every photograph selected for study. For example, the various facial breadth measurements obviously could be obtained only from profile photographs. Even so, every effort was



made to obtain as many index measurements as possible for comparison. More detailed descriptions of data reduction and analysis will be provided in the sections dealing with the individual problems of photographic comparisons.

(b) *Authentication of autopsy photographs*

1. INTRODUCTION

(561) The anthropology consultants were asked by the committee to examine postmortem radiographs and photographs taken during the autopsy of President Kennedy at the U.S. Naval Hospital on Nov. 22, 1963, and, if scientifically possible, determine whether or not they were in fact those of the President. The approach to this problem was through the comparison of the postmortem X-rays and photographs with those known to have been taken prior to his death.\*

(562) As noted previously in this appendix volume, the Kennedy assassination materials in the National Archives contain a series of negatives and prints of photographs allegedly taken during autopsy. The deficiencies of these photographs as scientific documentation of a forensic autopsy have been described elsewhere. (200) Here it is sufficient to note that:

(563) 1. They are generally of rather poor photographic quality.

(564) 2. Some, particularly close-up views, were taken in such a manner that it is nearly impossible to orient anatomically the direction of view.

(565) 3. In many, scalar references are entirely lacking, or when present, were positioned in such a manner to make it difficult or impossible to obtain accurate measurements of critical features (such as the wound in the upper back) from anatomical landmarks.

(566) 4. None of the photographs contain information identifying the victim; such as his name, the autopsy case number, and the date and place of the examination.

(567) In the main, these shortcomings bespeak of haste, inexperience and unfamiliarity with the understandably rigorous standards generally expected in photographs to be used as scientific evidence. In fact, in a criminal trial, the defense would probably raise many objections to an attempt to introduce such poorly made and documented photographs as evidence.

2. ISSUE

(568) Not all the critics of the Warren Commission have been content to point out the obvious deficiencies of the autopsy photographs as scientific evidence. Some have questioned their authenticity. These theorists suggest that the body shown in at least some of the photographs is not President Kennedy, but another decedent deliberately mutilated to simulate a pattern of wounds supportive of the Warren Commission's statements of their nature and significance. As macabre as this proposition might appear, the onus of establishing the authenticity of these photographs would have rested with the prosecution.

(569) With the above considerations in mind, the Committee requested the anthropology consultants to examine the questions sur-

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\*The discussion of postmortem X-rays is set forth in pars. 596-610 infra.



rounding the authenticity of the JFK autopsy photographs. Their inquiry was limited to determining the *identification* of the victim shown in the photographs. Other aspects of authentication concerning the possibility of technical alterations of the negatives and prints were undertaken by other photographic experts, as described elsewhere in this appendix. Questions concerning the description and location of the wounds and of their nature and significance, were considered exclusively by the forensic pathology consultants.

### 3. MATERIALS

#### *Post mortem*

(570) It has previously been recorded and the committee similarly found, that the autopsy materials in the National Archives, contain a total of 52 exposed transparencies and/or negatives. (201) These may be divided into two series: (1) 25 4 x 5 inch black-and-white and (2) 27 4 x 5 inch color negatives. The entire series is numbered sequentially beginning with the black-and-white series:

Black-and-white: No. 1-No. 25.

Color: No. 26-No. 52.

(571) Examination of prints of the total series revealed that most of the black-and-white negatives are virtually duplicates, in subject and view, to corresponding negatives in the color series. Consequently, our detailed analysis was limited to an examination of the color series. These items were in the form of high quality 8" x 10" prints specially prepared for the committee by a team of professors from RIT. Each print was identified by its original negative number. The entire series is described by subject in Table I.

#### *Antemortem*

(572) In order to compare the facial features of the autopsy subject with those of John F. Kennedy, a number of antemortem photographs of the President were examined. These were also furnished by the National Archives. Two of these (National Archives Accession Nos. 79-AR-6378G and 79-AR-8008K) were selected for a more detailed comparison since they show a full profile of the subject with his mouth slightly open, and in pose and camera angle correspond almost exactly with the full profile view of autopsy photograph No. 29.

### 4. CONCLUSIONS

(573) 1. The individual shown in the autopsy photographs is John F. Kennedy.

(574) 2. The brain shown in autopsy photographs No. 46-No. 52 cannot be positively identified as that of John F. Kennedy. Nevertheless, this brain displays trauma consistent with the known pattern of injury sustained by President Kennedy and, in the absence of any positive evidence to the contrary, there is no reason to believe that it is not the brain of the President.

### 5. ANALYSIS

(575) To examine the autopsy photographs from the standpoint of identification of the victim two hypotheses were considered:

(576) 1. That the subject shown in the photographs was not John F. Kennedy, but an unknown victim with a strong physical resemblance to the assassinated president.

(577) 2. That the victim in the photographs, in which the facial features are clearly visible, is in fact John F. Kennedy, but the body in which the face is not shown (particularly photographs No. 32 through No. 37 which document the location of the critical wounds of the back and head) is that of another, unknown, individual.

(578) In order to test the first hypothesis, it was necessary to compare the facial features of the victim in the autopsy photographs with antemortem photographs of President Kennedy. This comparison was made on the basis of both metric and morphological features.

(579) In making this comparison, it was first noted that there were no gross inconsistencies between the autopsy victim and general physical characteristics of President Kennedy. The victim is a well-nourished, dark-haired, middle-aged, white male who appears to be of northern European ethnic stock.

(580) The metric analysis was based on a comparison of autopsy photograph No. 29 with the two antemortem photographs (79-AR-6378G and 79-AR-8008K) selected from the National Archives series. The exact date of the antemortem photographs was not determined but both were made during the Kennedy presidency and therefore do not antedate the autopsy photograph by more than 3 years. All three photographs show the subject in nearly perfect facial profile; autopsy No. 29 and 79-AR-8008K are left profile and 79-AR-6378G is a right profile photograph.

(581) A series of 11 facial measurements were taken on each photograph. These measurements are defined in Table II and portrayed graphically in Figure IV-39. Measurements were recorded to the nearest 1.0 mm and made from 8" x 10" prints. Three sets of measurements were made on each photograph and the means were used to calculate the 10 indices given in Table III. The arrangement of President Kennedy's hair made it impossible to take physiognomic face height (mmt No. 1) in photographs 79-AR-6378G; otherwise, all the 11 measurements could be taken on each photograph.

(582) As shown in Table III, the index values of the autopsy photograph and the two antemortem photographs correspond very closely. For further comparison, the mean of the antemortem indices was compared with the postmortem values (represented by a single value in indices 1, 4, and 7 which are based on measurement No. 1 that could not be taken on 79-AR-6378G). The deviation between the antemortem and postmortem means range from 0.3 to 4.0 and the average deviation is 2.52 (Table III). This small deviation can be accounted for by a combination of several factors including that in the autopsy the subject is supine while he is standing erect in the antemortem photographs, and gravitational effects would cause some alteration of the facial features. The facial measurements would also be influenced by postmortem alterations and the effects of the massive cranial trauma. In short, the metric similarities, as expressed by facial indices are insignificant.

(583) In addition to the strong metric similarities between autopsy photograph No. 29 and the two antemortem photographs, a number of identical morphological features can be observed. The examination

of morphological similarities was not limited to the three photographs from which the measurements were taken but included comparisons between the other autopsy photographs that show the victim's face (No. 26, No. 27, No. 28, No. 29, No. 30, No. 31, No. 40, No. 41) and a series of 43 closeup photographs of President Kennedy selected from National Archives files to show his head and face from a variety of angles. In these comparisons, no inconsistencies in the morphological configuration of the eyes, nose, mouth, ears or other facial features were observed and, on the contrary, a number of identical features were apparent. These include rather distinctive traits such as the downward convexity of the nasal septum and an angular and elevated nasal tip (the latter, by the way, a trait observable in other members of the Kennedy family). Among similarities noted in the ears are a strong antihelix, small, "tucked" tragus, narrow intertragic notch and attached lobes. The lower margin of the helix is strongly concave at its junction with the lobe, giving the latter a rather attenuated appearance. Patterns of facial lines and wrinkles were similar where they could be discerned in the autopsy photographs.

(584) A partial list of morphological similarities between the autopsy subject and President Kennedy are shown in table IV. While they are simply listed in the table, each has a distinctiveness about it that impressed the examining anthropologists, both of whom have examined similar traits in a large number of human faces. Each of these traits, of course, can be separately observed in the general population. Nevertheless, the probability of their occurring together in a single individual is small. Their occurrence in two individuals with near-identical facial proportions, as expressed by the indices, is extremely remote.

(585) On the basis of the foregoing, it was concluded that the individual shown in the autopsy photographs that show the victim's face is beyond reasonable doubt, President John F. Kennedy.

(586) If it is accepted that the autopsy photographs showing the victim's face are those of John F. Kennedy, it then is necessary to examine the second hypothesis—namely that the remaining autopsy photographs are those of another person.

(587) Examination of table I shows that the entire series of 27 autopsy photographs can be grouped as follows:

<i>Groups</i>	<i>Negative Nos.</i>
1. Left lateral views-----	29, 30, 31.
2. Right lateral views-----	26, 27, 28, 40, 41.
3. Superior views-----	38, 39, 42, 43.
4. Posterior views-----	32, 33, 34, 35, 36, 37.
5. Cranial cavity-----	44, 45.
3. Brain -----	46, 47, 48, 49, 50, 51, 52.

(588) The photographs within each of the groups vary only slightly in camera angle, lens-subject distance, subject position, lighting and exposure. There is also sufficient commonality in morphological features and other details to leave no doubt but what they are of the same subject. Since we have concluded that photographs in groups 1 and 2 (showing the face) are those of President Kennedy, these features can be compared with features observed in the other photographs.



(589) From the standpoint of pathological interpretation, the least informative photographs are those of group 3, which provide a superior view of the head and shoulders. This is because the scalp has neither been shaved nor reflected from the cranium, procedures which would possibly have shown some of the crucial details of the cranial trauma. In these photographs, a portion of the victim's forehead and nose are shown from above. The configuration of these facial features are consistent with the nose and upper forehead contours of President Kennedy as surmised from the antemortem photographs taken from more conventional angles. Also, certain random features such as blood-stains and an apparent postmortem abrasion on the right shoulder (described in more detail below), which can be seen in the photographs of group 2, can be observed in this set of photographs. It was concluded therefore, that these photographs are of the same person as shown in groups 1 and 2 of the autopsy photographs; to wit, John F. Kennedy.

(590) The most critical set of photographs from the standpoint of identification are those of group 4 that show the head and upper back of the victim from behind. To take these photographs, the victim was apparently raised to a semi-upright position and held there while the pictures were taken from the head of the autopsy table. The purpose of these photographs was to document the scalp and upper back wounds, the exact location of which has been a matter of considerable controversy. In these photographs, the only facial features visible are the backs of the ears.

(591) In comparing these photographs with those taken in group 2, which show the right side of the head and face, several features common to both were noted. These include two dried blood stains on the upper right shoulder approximately 16 centimeters lateral to the midline of the back. Approximately 7 centimeters medial to these are a series of three narrow parallel marks approximately 3 centimeters in length, which appear to be slight skin abrasions. These marks and stains are situated several centimeters lateral to the back wound and do not appear to be directly associated with it. It is possible that they were made in the course of handling and lifting the body.

(592) There is also a 3- by 5-centimeter area of discoloration at the base of the neck in the right area that apparently represents either a slight contusion or some postmortem lividity. All of these features are very irregular in shape and would thus be very difficult if not impossible to duplicate. Such minor and random details are also the kind of characteristics that would likely be overlooked in any attempted hoax. Likewise, the hair, which is in disarray and matted with blood and body fluids, presents a complex of irregularly arranged strands and locks. Yet, allowing for the different angles of view, these features appear to be identical in size, location, and shape in both the posterior (group 4) photographs and those of the right lateral photographs of group 1, which can be identified as being of President Kennedy.

(593) In addition to the above rather transient features, others of a more permanent nature were noted. These were the network of transverse wrinkles extending across the back and side of the neck. Such lines develop in most individuals by middle age, but their exact arrangement forms a pattern that is virtually unique to the individual. Examination of these in the back photographs of group 4 shows that they are identical in pattern and development (again making allowance for view) as those seen on the lateral side of the neck in

the group 1 photographs. In short, the profusion of minute and common detail led the panel to conclude that the same individual is shown in both sets of photographs.

(594) The photographs of group 5, which show the cranial cavity with the brain removed, are somewhat more difficult to evaluate. One feature of interest is the outline of the fractured margin of the frontal bone that is partially visible in the foreground of these photographs. A deep V-shaped irregularity in this margin is also visible in photographs of group 1 in which the scalp is partially reflected to expose the underlying bone. The anterior margin of the cranial defects also corresponds in shape to the fractures observed in the cranial X-rays. (595) From the standpoint of positive identification, the most problematical group of autopsy photographs are those of group 6 which show the isolated brain. Here the panel could find no anatomical features that would associate this brain with the remaining autopsy photographs. Nevertheless, the trauma to the brain, affecting primarily the superior aspect of the frontal lobes is certainly consistent with the pattern of cranial trauma observed in the X-rays and other autopsy photographs.

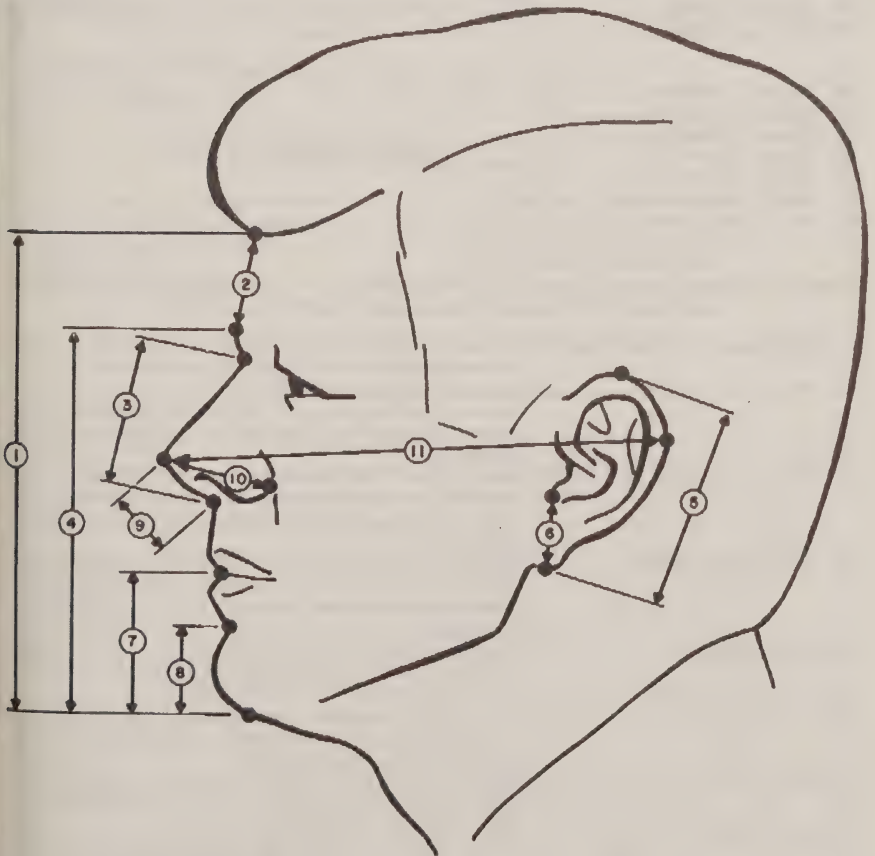


FIGURE IV-39.—Diagram of Measurements Set Forth in Table I.

TABLE 1.—Description of autopsy photographs examined in authentication study

Number		
26	Head, right lateral	} Superio-lateral view of head in quarter profile. Includes anterior neck wound, upper chest and shoulders.
27	Head, right lateral	
28	Head, right lateral	
29	Head, left lateral	} Profile view. Includes anterior neck wound. No. 30 overexposed.
30	Head, left lateral	
31	Head, left lateral	
32	Head, superior	} Superior view of head and shoulders.
33	Head, superior	
34	Head, superior	
35	Head, superior	
36	Head, superior	
37	Head, superior	
38	Upper torso, posterior	} Shows shoulder wound.
39	Upper torso, posterior	
40	Head, right lateral	} Inferio-lateral view of head in quarter profile. Includes anterior neck wound.
41	Head, right lateral	
42	Head, posterior	} Close-up of occipito-parietal area showing scalp wound.
43	Head, posterior	
44	Cranial cavity	} Anterio-superior views of cranial cavity. Brain removed.
45	Cranial cavity	
46	Brain, inferior	} Removed from cranial cavity.
47	Brain, inferior	
48	Brain, inferior	
49	Brain, inferior	
50	Brain, superior	
51	Brain, superior	
52	Brain, superior	

TABLE II.—Measurements used to derive indices for comparison of JFK ante-mortem photographs with autopsy photographs No. 29

1. Physiognomic face height—Distance from the midpoint of the hairline to the lowest point on the chin (*trichion to menton*).
2. Forehead height—Distance from the midpoint of the hairline to the most anterior point on the lower forehead just above the nasal root depression (*trichion to glabella*).
3. Nose length—Distance from the deepest point of the nasal root depression to the junction point between the nasal septum and the upper lip (*subnasion to subnasale*).
4. Total face height—Distance between the most anterior point on the lower forehead just above the nasal root depression and the lowest point on the chin (*glabella to menton*).
5. Ear length—Distance between the uppermost point on the helix of the ear and the lowermost point on the earlobe (*superaurale to subaurale*).
6. Lobe length—Distance between the lowest point in the intertragic notch and the lowest point of the earlobe (*intertragon to subaurale*).
7. Mouth height—Distance from the point of contact between the upper and lower lip and the lowest point on the chin (*stomion to menton*).
8. Chin eminence height—Distance from the point of deepest depression between the lower lip and chin and the lowest point on the chin (*supramentale to menton*).



9. Nasal projection-----Distance from the most anterior point on the nasal tip to the junction point between the nasal septum and the upper lip (*pronasale to subnasale*).
10. Nasal elevation-----Distance from the most anterior point on the tip of the nose to the posterior most point on the junction line between the nasal alae and the cheek (*pronasale to postalarale*).
11. Total facial depth-----Distance between the most anterior point on the nasal tip and the posterior most point on the posterior margin of the helix of the ear (*pronasale to postaurale*).

TABLE III.—COMPARISON OF FACIAL INDEX VALUES OF ANTEMORTEM PHOTOGRAPHS OF PRESIDENT JOHN F. KENNEDY (79-AR-6378G, 79-AR-800K) WITH LEFT PROFILE PHOTOGRAPH (NO. 29) OF AUTOPSY SUBJECT

Index (M/M×100) <sup>1</sup>	Antemortem			Postmortem (No. 29)	Δ <sup>2</sup>
	79-AR-6378G	79-AR-8008K	Mean		
1. 2/1×100-----		27.0	27.0	30.7	3.7
2. 3/4×100-----	26.4	35.1	35.8	33.1	2.7
3. 8/4×100-----	21.4	21.1	21.2	18.1	3.1
4. 7/1×100-----		28.4	28.4	23.6	2.8
5. 7/4×100-----	37.1	36.8	37.0	33.8	3.2
6. 6/5×100-----	29.4	33.9	31.6	33.9	2.3
7. 5/1×100-----		41.2	41.2	37.5	3.7
8. 9/3×100-----	47.1	45.0	46.0	50.0	4.0
9. 10/3×100-----	60.8	61.5	61.2	63.6	2.4
10. 5/11×100-----	49.7	45.9	47.8	47.5	.3

<sup>1</sup> Numbers refer to measurements defined in table II.

<sup>2</sup> Absolute differences between mean of antemortem index and postmortem index.

Note: Mean deviation equals 2.82.

TABLE IV.—*Morphological similarities in both the ante mortem and post mortem Kennedy photographs*

Convex angle of nasal septum.	"Tucked" ear tragus.
Lower third of nose convexity.	Distinctive lip profile.
Nasal tip area elevated.	Identical facial crease lines.
Attached ear lobe.	Similar neck crease lines.
Strong ear antihelix.	

### (c) Authentication of Autopsy X-rays

#### 1. INTRODUCTION

(596) Human bone structure varies uniquely from one individual to another. The bones not only differ in their overall size and shape but also in their minute structural details so that the total pattern of skeletal architecture of a given person is as unique as his or her fingerprints. Forensic anthropologists have long made use of this fact in establishing the positive identification of persons killed in combat, aircraft accidents, or other disasters, by comparing X-rays taken before death with those of the unidentified body taken after death.

(597) Of course, just as no two individuals are alike, no two X-rays of the same bones of the same person are ever exactly alike because there is always some variation in the positioning of the subject, the X-ray technique, and the processing of the film. The skeleton also undergoes some remodeling throughout life so that a certain amount of variation in detail is to be expected in films of the same individual taken a few years apart. Nevertheless, with experience, these technical and age variations can be taken into account so that, given a pair of reasonably good films of the same person, posed in the same way, a

positive identification can nearly always be made even if the X-rays were made many years apart by different technicians using different equipment.

(598) In the following analysis the committee applied this method in comparing the post mortem X-rays said to be those of President Kennedy with clinical films known to have been taken prior to his death.

## 2. ISSUE

(599) Just as they have questioned the autopsy photographs, critics of the Warren Commission have suggested that the autopsy X-rays are not those of President Kennedy. The committee asked the anthropology consultants to examine the X-rays to determine if they are of the President.

## 3. MATERIALS

(600) Both ante mortem and post mortem X-rays examined were from the JFK assassination materials curated by the National Archives.

(601) The autopsy X-rays bear the case number "21296" of the U.S. Naval Hospital in Bethesda, Md. They include front and side views of the skull as well as a series of overlapping views of the torso and upper legs. There are also several X-rays of three skull fragments reportedly found in the Presidential automobile after the assassination.\*

(602) In addition to the autopsy X-rays, the Archives collection includes three sets of clinical X-rays of President Kennedy taken at various times prior to his death. Two of these sets were made by personal physicians who treated the then-Senator Kennedy for an upper respiratory illness in August 1960. The earliest, dated August 14, bears the case number "202617" of Dr. Stephen White, 521 Park Avenue, New York. The second set was made 3 days later at the clinic of Drs. Groover, Christie, and Merritt of 1835 I Street NW., Washington, D.C., and bears the case number "336042." Dr. White's series consists of a side view of the head and a routine chest plate. Those from the Groover, Christie, and Merritt Clinic include side and front views of the skull. The third set of ante mortem X-rays were taken at the U.S. Naval Hospital in Bethesda on March 14, 1962, while President Kennedy was undergoing treatment for a back complaint. These X-rays consist of front and side views of the lower spine and pelvis. Hereafter, these three sets of ante mortem X-rays will be referred to as the "White," "Groover," and "Navy" films, respectively.

## 4. CONCLUSION

(603) Both the skull and torso autopsy radiographs, now in the possession of the National Archives, are X-rays of President John F. Kennedy.

## 5. ANALYSIS

(604) First the "Groover" and "White" ante mortem X-rays of the skull were compared with the autopsy films. In the front views, it was found that the outlines of the frontal sinuses of the autopsy X-rays

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\*A list of these materials is set forth at pars. 516-522 *supra*.

were virtually superimposable on those shown in the clinical X-rays. The sinuses, which are lobular air pockets inside the bone that forms the forehead, vary uniquely in size and shape from one person to another. This variability is seen particularly in the outlines of their upper margin which typically cast a set of scalloplike shadows on the X-ray. This scallop pattern is so individually distinctive that forensic anthropologists have termed them "sinus prints." For many years, courts of law throughout the world have accepted the matching on ante mortem and post mortem X-rays of the sinuses as evidence for the positive identification of unknown bodies. In the present case, the similarity in shape of the sinus print patterns in the ante mortem and post mortem films is sufficient to establish that they are of the same person on the basis of this trait alone.

(605) In addition to the sinus prints, several other strikingly similar anatomical features were observed in the front view X-rays. For example, the nasal septum—the thin wall of cartilage and bone that separates the nostrils—was deviated to the same side and to an identical degree in ante mortem and post mortem films. Also, the outlines of the bony rims of the orbits of the eyes were nearly identical. The very slight variations observed in these three features—sinus pattern, nasal septum, and orbital margins—are the results of minor differences in the way the X-rays were taken.

(606) The profile views of the skull in the White and Groover films were next compared to the autopsy X-rays. Again, a number of almost identical anatomical features were observed in the ante mortem and post mortem films. For example, the outlines of the *sella turcica* (the saddle-shaped depression in the base of the skull), the complex patterns of the cranial sutures (the joints uniting the bones of the skull), and location and arrangement of the vascular grooves (the shallow depressions on the inner surface of the skull which mark the course of blood vessels) were the same. There was also nearly exact duplication of the honeycomblike air cells of the mastoid bone.

(607) The chest X-ray taken by Dr. White in 1960, was next compared to those of the upper torso taken at autopsy. Again, a number of identical features were noted in both sets of films. Among these were the outlines of the dorsal spines of the thoracic vertebrae. (These spines are the bony projections that are visible just under the skin along the center of the back.) In X-rays these spines project a vertical series of small shadows of varying sizes and shape that, like the architectural features of the skull discussed above, are virtually unique in each individual. In shape these shadows may range from almost perfect circles to irregular trapezoids. They vary not only from one individual to the next but from one vertebra to another in the same individual so that the series of a dozen or so of these spines, usually visible in a standard chest film, form a combination of shapes distinctive for each individual. Allowing for slight distortions due to position and technique, this series of spines can be considered identical in the antemortem and postmortem films.

(608) In addition to the similar pattern of dorsal vertebrae spines, a number of other features common to both sets of film were observed. For example, the size and shape of the medial ends of the clavícula (collar bones) were identical, as was the pattern of ossification of the costo-chondral junctions of the first ribs. Numerous details in the form



and trabecular structure of the ribs could also be matched from one set of films to the other, particularly in the left eighth and ninth ribs which were especially well-defined in both films.

(609) The autopsy radiographs of the lower torso, including the pelvis and upper legs, could be compared to the antemortem Navy films taken in 1962. These also show an impressive number of osseous details in common. Of particular interest was the right transverse process of the fifth lumbar vertebra. In both sets of films it was displaced upwards in a manner suggestive of a congenital malformation or an old, ununited fracture.

(610) To summarize, the skull and torso radiographs taken at autopsy match the available ante mortem films of the President in such a wealth of intricate morphological detail that there can be no reasonable doubt that they are in fact X-rays of John F. Kennedy, and no other person.

*(d) Comparison of photographs of Joseph Milteer with that of an unidentified Dallas motorcade spectator*

#### 1. INTRODUCTION

(611) An unidentified motorcade spectator who bears a strong resemblance to Joseph Adams Milteer, a militant right-wing organizer who is alleged to have been a possible coconspirator in the assassination, appears in the background of a photograph that was taken by Associated Press photographer James W. Altgens less than a minute before the assassination occurred. (202) The presidential limousine can be seen passing the Dal-Tex building on Houston Street just before the vehicle turned south onto Elm Street in front of the Texas School Book Depository Building. The spectator in question is seen standing on the east side of Houston Street, just beyond the limousine. He is a white male appearing to be about  $60 \pm 10$  years of age. Immediately to his right is a taller man wearing a dark hat, coat and necktie. (See figure IV-40, JFK Exhibit F-124).



FIGURE IV-40.—Altgens 1-5 photograph taken on Houston Street.

(612) Milteer's possible involvement in the assassination was first brought to public attention by Harold Weisberg, the author, who described a taped conversation that allegedly took place in Miami, Fla. 13 days before the assassination between Milteer and a Miami police informant, Willie A. Somerset (both now deceased).<sup>(203)</sup> During the taped discussion, a voice identified as that of Joseph Milteer says that a plan to kill the President is "in the working" and describes how the President could be shot "(f)rom an office building with a high-powered rifle."<sup>(204)</sup> FBI documents describe subsequent interviews, both with a "reliable informant,"<sup>(205)</sup> relating further incriminating comments by Milteer regarding the events of the assassination,<sup>(206)</sup> and with Milteer, who denied any involvement.<sup>(207)</sup> These FBI documents were retained in the Warren Commission files, but the Commission is said not to have investigated this matter further.<sup>(208)</sup>

(613) Assassination critics raise the possibility that Milteer was an active participant in a conspiracy and present in Dealey Plaza at the time of the assassination as evidenced by the Altgens photograph.<sup>(209)</sup> The man the critics claim is Milteer also appears in a few frames of the Bell, Nix and Muchmore motion picture films.

## 2. ISSUE

(614) By comparing known photographs of Milteer with photographs of the motorcade spectator in Dealey Plaza, is it possible to determine whether the spectator, in fact, is Milteer?

## 3. MATERIALS

(615) (a) The photographs of Joseph Milteer consist of the following items:



FIGURE IV-41.—Undated studio photographs of Joseph Milteer.

Figure IV-41.—Two undated 5 x 7-inch black-and-white studio portraits stamped "Modern Studio, 219 W. Adams Street, Jacksonville, Florida." In these, the subject appears to be about  $40 \pm 5$  years old. As Milteer was born in 1902, these photographs probably date from the 1940's or early 1950's.

Figure IV-42.—A 3 x 3-inch snapshot of Milteer seated in a chair. A 1957 calendar appears in the background.

Figure IV-43.—A 3 x 4-inch black-and-white photograph. This photograph is undated, but judging from the subject's apparent age is obviously later than Figure IV-41 photographs and probably also later than figure IV-42.

Figure IV-44.—A 3.5 x 5.5-inch black-and-white photograph of Milteer standing beside an unidentified elderly woman. It is undated, but is said to have been taken in the early 1970's when Milteer was about 70 years old.





FIGURE IV-42.—Color snapshot of Joseph Milteer. Note 1957 calendar in background.



FIGURE IV-43.—Undated photograph of Joseph Milteer.



FIGURE IV-44.—Photograph of Joseph Milteer taken in early 1970's.

(616) (b) Prints of the spectators were made from the original Altgens negative. (See fig. IV-45, JFK Exhibit F-563). In addition both the Altgens negative and relevant frames of the Bell film were subjected to digital image processing. (210)\* (See fig. IV-46).

#### 4. CONCLUSIONS

(617) Milteer resembles the Kennedy motorcade spectator in age and general facial configuration. The spectator appears to have worn eyeglasses similar in general style to those favored by Milteer. The spectator, however, does not resemble Milteer in upper lip thickness; he is also partially bald, whereas Milteer apparently had a full head of hair in the photograph that was taken several years after the assassination. (See fig. IV-44). Most significantly, Milteer's reported stature of

\* Computer enhancement of the spectator as seen in the Bell film did not produce usable results.



64 inches places him about 6 inches under the spectator's estimated stature.\*

(618) In the absence of evidence that (1) Milteer had become extensively bald by 1963 or was wearing a hairpiece in the postassassination photograph, or that (2) Milteer's statural estimate of 64 inches is incorrect, the motorcade spectator could not have been Joseph Milteer.

## 5. ANALYSIS

### *First. Metric analysis*

(619) Although several enlargements and an enhanced photograph of the spectator have been furnished for examination, they are not sufficiently sharp to permit any meaningful comparison based on facial measurements and indices. (See fig. IV-46).

### *Second. Age*

(620) The age of the motorcade spectator is estimated at  $60 \pm 10$  years. Milteer was approximately 61 years old in 1963. (211)

### *Third. Eyeglasses*

(621) In all three photographs of Milteer taken during his later years he is wearing eyeglasses with composite frames (plastic upper rims, wire lower) and a broad metal nose piece. (See figs. IV-42 and IV-44). The spectator is also wearing spectacles which appear to be of the same general style favored by Milteer. (See fig. IV-46.)

### *Fourth. Lip thickness*

(622) All of the available Milteer photographs show that the membranous position of Milteer's upper lip was very thin. The enhanced photographs of the spectator suggest a rather full and thick upper lip. (See fig. IV-46). This is not a trait apt to be influenced by normal variation in facial expression.

### *Fifth. Hair*

(623) In the earliest photographs Milteer has a full, regular hairline with no central or lateral retreat suggestive of incipient baldness. (See figure IV-41). In the photograph that was apparently taken when Milteer was about 55 years old, his hairline is virtually identical to that of the earlier photographs. (See figure IV-42). The latest photograph, taken about a decade after the assassination, shows Milteer with a full head of hair. (See figure IV-44). The spectator, however, appears to have little, if any, hair. The extent of his balding, though, could not be ascertained; no hairline is visible, and in fact, the entire frontal crown of his head appears bare. (See figure IV-46).

### *Stature*

(624) The only available height record on Milteer gives his stature as 64 inches. (212) This corresponds to about the seventh statural percentile of American males. That is, about 93 out of 100 adult American men would be taller than Milteer. Also, about 35 percent of adult American females would exceed Milteer's reported height. (213) In contrast, the spectator alleged to be Milteer is taller than 4 of the 7 other males and all of the 16 females in the line of spectators shown in the motorcade photograph. Based upon Milteer's reported height, the

\*See *infra*, pars. 625-659.

probability of randomly selecting a group of Americans where so many are shorter than Milteer's reported height is .0000007. Moreover, an analysis based upon actual measurements of certain physical features shown in the photograph yields a height estimate for the spectator of about 70 inches—6 inches taller than Milteer's reported stature.\*

## ADDENDUM

### HEIGHT ANALYSIS OF ALLEGED JOSEPH MILTEER

(625) According to the only known physical description of Milteer, he was 64 inches (162.6 cm) in height. (214) As errors of as much as  $\pm 2$  inches are not uncommon in police and medical records, (215) we will assume that his true stature was somewhere between 62 and 66 inches (157.5–167.6 cm). The key question, then, is whether or not the stature of the motorcade spectator falls within the estimated stature range of Milteer. If so, the finding would not, of course, prove that the spectator was indeed Milteer but would at least be consistent with this theory. If, however, the spectator's stature falls outside the range, it would substantially decrease the likelihood that he is Milteer.

#### *Materials and methods*

(626) The photograph on which the following analysis was based was taken from the intersection of Main and Houston shortly after the presidential limousine had turned right onto Houston Street from Main. (See figure IV-40). The view takes in the entire front of the Dallas County Records Building and a portion of the Dal-Tex Building. Direction of view is toward the northeast.

(627) In this photograph, the spectator in question is a balding white male in a light-colored short-sleeve shirt who appears to be about  $60 \pm 10$  years of age. He is standing in the line of spectators arrayed along the sidewalk in front of the records building. Immediately to his right is a tall white male in a dark suit and hat.

(628) For the analysis, the committee furnished the original 35 millimeter black-and-white negative taken by James Altgens. Our photographic measurements were made from an 8 x 10 inch enlargement of the negative. See figure IV-45. Angular measurements were recorded to the nearest 0.10 and taken with a Lutz-10 inch protractor. Linear measurements were taken with a needlepoint Helios dial caliper to the nearest 0.1 millimeter. Each angular and linear measurement reported here represents the mean of three trials.

#### *The site*

(629) A map of the site (Warren Commission exhibit 882, 17:901) shows the sidewalk fronting the records building to be of uniform width (10 feet) from the Houston-Elm corner southward to where it curves into the driveway between the records building and the Criminal Courts Building. From measurements by the committee (216) the elevation of the sidewalk in relation to the records building was found to be uniform. The street, however, slopes slightly upward so that the curb is higher near the driveway entrance than at the Houston-Elm corner.

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\*A detailed analysis of the available statural data is given infra, pars. 625–659.

### Signposts

(630) Physical features of particular importance in the following analysis are the two tall street signposts located a short distance north of the spectator alleged to be Milteer. (See fig. IV-45). Each post holds three vertically arranged signs, the lowest of which bears the notice "no parking except police officers." According to information supplied by the committee, the standard dimensions for such signs in Dallas are 12 x 18 inches and, in 1963, city regulations specified that the bottom edge of the lowest sign be set 80 inches above the sidewalk. (217)

### Vertical and horizontal reference lines\* of motorcade photograph

(631) The vertical reference line (VRL) of the motorcade photograph is taken as coincident with the northwest corner of the Dallas County Records Building.

The horizontal reference line (HRL) which represents the elevation of the center of the camera lens, can be calculated from the perspective angles of two transverse masonry seams that run across the west face of the records building. (See fig. IV-45). The upper of these seams passes along the bottom edge of a large window. The lower line is partially obscured by the heads of the spectators. The upper line slopes upward, and the lower line slopes slightly downward from left to right; therefore, the HRL must pass between them and also perpendicular to the VRL.

(632) The law of perspective dictates that the two masonry lines, if extended indefinitely, would meet at the vanishing point of the photograph.\*\* Consequently, their extensions may be visualized as forming the sides of a triangle, ABC, the apex of which is the vanishing point and the base of which is that segment of the VRL subtended by the angle of convergence of the masonry lines. Since, as noted above, the HRL must pass between the masonry lines and is also perpendicular to VRL, it can be visualized as subdividing the triangle ABC into two smaller right triangles AHC and HBC (See figure IV-47).

(633) The angles  $\alpha$  and  $\alpha'$ , measured from the photograph are  $89.0^\circ$  and  $87.5^\circ$ , respectively, and

$$\begin{aligned}\beta &= 90.0 - 89.0 = 1.0^\circ \\ \beta' &= 90.0 - 87.5 = 2.5^\circ\end{aligned}$$

and since

$$\frac{AH}{AB} = \frac{AH}{AH + AB} = \frac{\tan \beta}{\tan \beta + \tan \beta'} = \frac{\tan 1.0^\circ}{\tan 1.0^\circ + \tan 2.5^\circ} = .286$$

the distance of HRL above the intersection of the lowest masonry line with VRL is about 28.6% ( $= .286 \times 100$ ) of the total distance between the masonry lines. When projected onto the photograph, the HRL is seen to pass slightly above the head of the alleged Milteer. (See Figure IV-47).

\*Measurements are made above and below a hypothetical plane known as the datum plane or horizontal reference line, analogous to measurements that a geographer reports relative to sea level. Vertical distances are measured along or parallel to a vertical reference line that runs perpendicular to the horizontal reference line.

\*\*For a discussion of the "vanishing point" concept see pars. 414-417 *supra*.





FIGURE IV-45.—Enlargement of original Altgens photograph used in stature analysis of spectator alleged to be Joseph Milteer.



Enhancement by digital image processing



FIGURE IV-46.—Enlarged enhancements of spectator from Altgens photograph.

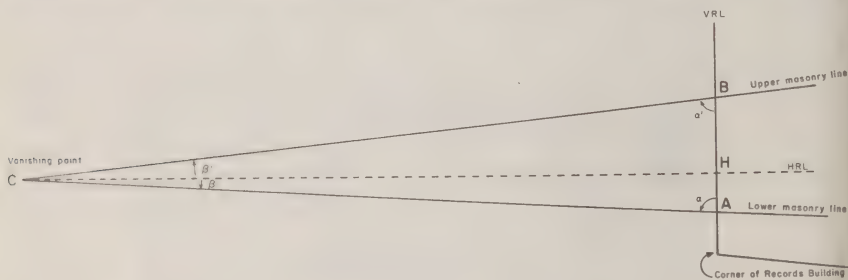


FIGURE IV-47.—Derivation of the vanishing point (C) and the horizontal reference line (HRL) from the Altgens photograph, using masonry lines and the northwest corner of the Dallas County Records Building as the vertical reference line (VRL).

### *The spectators*

(634) Approximately 60 spectators are shown in the motorcade photograph. (See figure IV-40). They are standing in an irregular line stretching from the south end of the Records Building northwards to the vicinity of the southwest corner of the Dal-Tex Building. At the south end of this line are five males, four of whom are standing in the street in front of an automobile parked near the driveway entrance. The fifth man of this group is sitting on the fender of the automobile. At the north end of the line, extending from the southeast corner of the sidewalk of the Houston-Elm intersection, most of the spectators are also standing in the street.

(635) Between these two groups, is an intermediate segment of the spectator line consisting of 28 individuals, including the alleged Milteer. (See figure IV-45). In the motorcade photograph, the lower bodies of these spectators are obscured by the presidential limousine so that it is impossible to determine whether they are standing in the street or on the curb. Nevertheless, other motorcade films show that the individuals in the north portion of this line, including the spectator under investigation, are standing along the edge of the sidewalk. (218) Judging from their relative height and position, it seems reasonable to assume that the persons in the south end of this line are also on the sidewalk. At the south end of this line is a white female shading her eyes with a parcel held in her left hand; the line ends with a Black man wearing a dark hat who is standing just to the left of the utility pole at the northwest corner of the Records Building.

(636) Besides the alleged Milteer, this group of sidewalk spectators consists of 27 individuals. The sex of two cannot be determined as they are nearly totally obscured by other spectators. Among the remaining 25 are 17 women and 8 men. Two of these spectators, a male in a non-military uniform, and a very short female standing immediately on the left of the man alleged to be Milteer, appear to be rather young individuals who may not have attained adult stature. The remaining 7 males and 16 females are adults ranging from about 20 to 60 years of age. Two of the males and six of the females are Black. Judging from their short stature and rather dark complexions, it is possible that as many as 4 of the 10 Caucasoid females may be of Mexican-American ethnic extraction.

(637) Thus, in terms of age and ethnic composition, the group seems fairly representative of the urban population of Dallas during the 1960's. (219) The preponderance of females might be accounted for by the relatively large number of women employees in the many retail stores, business offices and local government agencies in this area of downtown Dallas. Barring undue sampling errors, the average stature of both sexes in the group might be expected to approximate the mean stature of the general U.S. adult population.

#### *Methods of analysis*

(638) The hypothesis that the spectator's stature falls within Milteer's stature range of  $64 \pm 2$  inches can be tested by two methods:

(639) 1. Estimation of the spectator's height in relation to the street signs; and

(640) 2. Relating his height to the heights of the other sidewalk spectators.

(641) Although possibly redundant, using both methods is advantageous as they are independent; that is, neither relies on information used in the other. More specifically, the first method could be used even if the alleged Milteer were standing alone on the sidewalk and, conversely, the second method does not depend on the presence of the street signs in the photograph. As each method is based upon different assumptions and subject to different errors, they provide a valuable check upon one another.

(642) Both methods share the assumption that the elevation of the sidewalk, from north to south, is uniform. Beyond this, each method has a unique assumption:



(643) *Method 1.*—The signpost dimensions provided the Committee by Dallas Street Department officials are correct. This must be assumed because the actual signs seen in the 1963 photograph have been removed and, thus, can no longer be measured directly.

(644) *Method 2.*—In using this method it is assumed that, as a group, the stature of the adult men and women standing along the sidewalk approximate the statural norms of the general U.S. population of the 1960's.

*Test 1: Estimation of height from street signs*

(645) If the spectator happened to have been standing against one of the signposts, it could be used as a simple measuring rod to obtain a measurement of his stature. Unfortunately, this is not so; therefore this would violate the geometric rules of perspective by simply passing a horizontal line across the top of the spectator's head and using its intersection with one of the signposts as the measuring point.

(646) Imagine, however, that there was a third sign, identical to the other two, positioned immediately behind the spectator. Such a sign would provide an ideal measuring rod as the spectator is standing by the edge of the sidewalk.

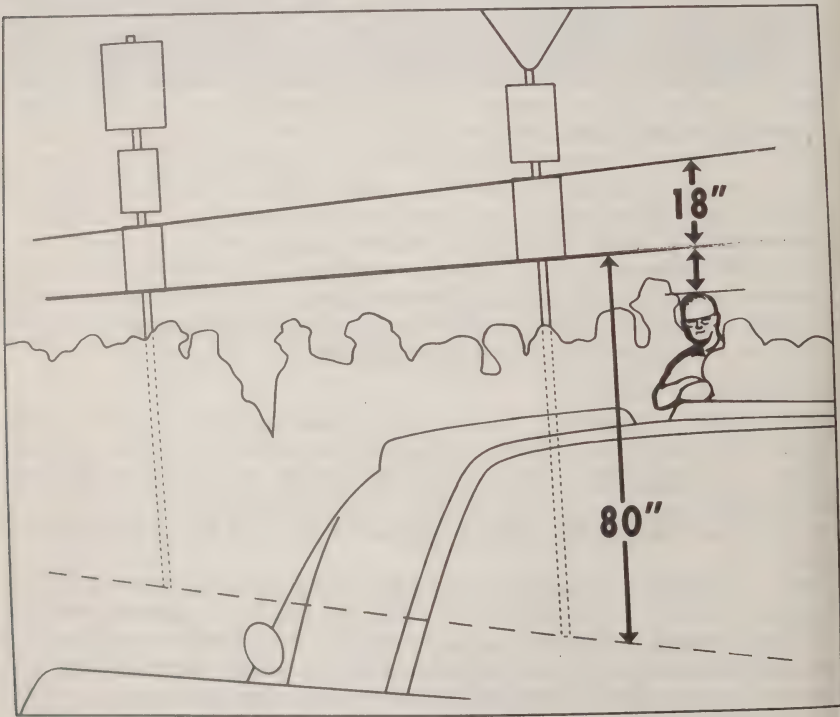


FIGURE IV-48.—Estimation of spectator's height from street signs.

(647) Taking the laws of perspective into account, this imaginary sign can be constructed by passing two lines connecting the tops and bottoms of the real signs to a point immediately above the top of the spectator's head. A vertical line, perpendicular to HRL, passing upward from the top of the spectator's head represents the post of the imaginary sign. (See figure IV-48, JFK exhibit F-562.) This sign will have the same actual dimensions of the other two: its length is 18 inches and its lower border is 80 inches above the sidewalk. From these relationships the spectator's stature can be calculated from the

formula: Stature, inches =  $H - \frac{sd}{s'}$  where

$H$  = height of lower border of sign above sidewalk in inches

$s$  = actual length of sign in inches

$s'$  = length of sign measured on photograph in millimeters

$d$  = distance from top of spectator's head to lower border of sign measured on photograph in millimeters

(648) In the present case,  $H=80$  inches,  $s=18$  inches,  $s'=16.1$  mm and  $d=9.1$  mm, so

$$\begin{aligned} \text{spectator's stature} &= 80 - \frac{(18 \times 9.1)}{16.1} \text{ inches} \\ &= 80 - 10.2 \text{ inches} \\ &= 69.8 \text{ inches} \end{aligned}$$

(649) In round figures, the stature of the alleged Milteer would have been about 70 inches (177.8 cm) or 5 foot, 10 inches. Thus, he would have been about 2.5 inches taller than the average 55-64 year old U.S. male of the early 1960s. (220) More importantly, he exceeds Joseph Milteer's reported stature of 64 inches by 6 inches.

#### *Test 2: Stature relative to other spectators*

(650) Just as an imaginary sign has been created, it may be imagined that the two real signs have vanished. Now there is no convenient measuring rod against which the spectator's stature may be measured. Nevertheless, inspection of the photograph shows that, among the adult spectators lining the sidewalk, only one, the man in the Black hat standing next to him, is clearly taller than the alleged Milteer. (See figure IV-49, JFK exhibit F-563). Allowing for perspective, it is possible that the two Black males toward the end of the line are also taller; if it is assumed they are, then four of the seven males can be counted as shorter than the spectator. He is also definitely taller than all of the 16 adult females among the sidewalk spectators.

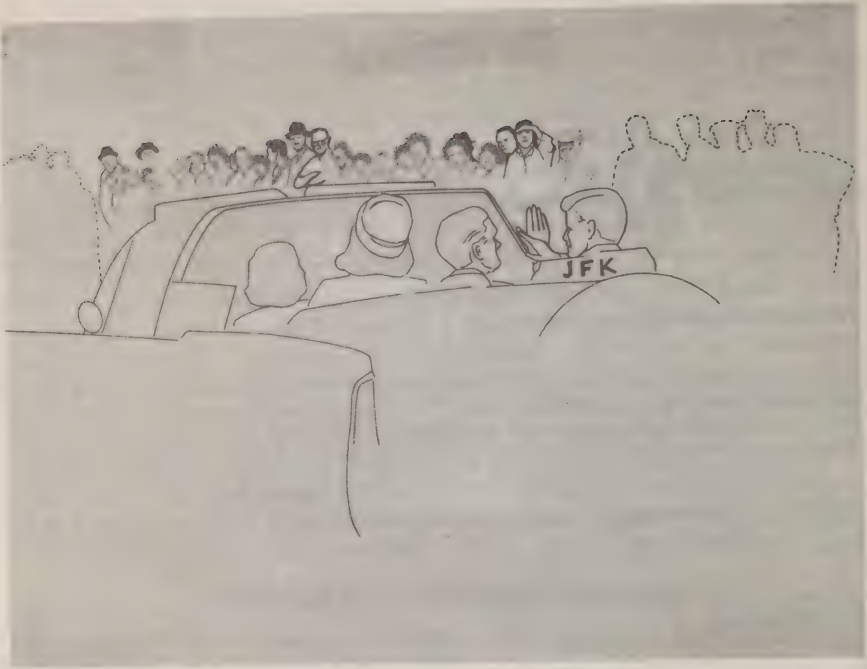


FIGURE IV-49.—Spectator's stature relative to other bystanders.

(651) Consider then the null hypothesis that the spectator is actually only 64 inches in height. If so, he has managed to insert himself among an apparently random group of 23 adults of whom 7 men and 16 women are shorter than he. Such an elfin array would be unlikely to congregate through chance alone in downtown Dallas, Tex.

(652) According to a nationwide anthropometric survey of adult Americans conducted in 1960-62, the median height of males was 68.3 inches (173.5 cm) and of females 62.9 inches (159.8 cm). Furthermore, only about 7 percent of men were under 64 inches in height. Approximately 65 percent of adult females were shorter than 64 inches. (221) Stated differently, if the spectator's stature was only 64 inches, he would be shorter than about 93 percent of adult men and 35 percent of adult women.

(653) As adult stature is normally distributed, the probability of randomly selecting a group of 16 adult women shorter than 64 inches from the general population is as follows:

$$P \text{ } \text{?} \text{ } 16 \leq 64'' = C_{16, 16} (.65)^{16} \\ = .00102 \text{ or about } 1 \text{ in } 1000.$$

(654) The probability of randomly selecting a group of seven American men, four of whom are less than 64 inches in height is as follows:

$$P \text{ } \text{?} \text{ } 4 \leq 64'' \leq 7 = C_{7, 4} (.07)^4 (.93)^3 + C_{7, 5} (.07)^5 (.93)^2 + C_{7, 6} (.07)^6 (.93) + C_{7, 7} (.07)^7 \\ = .00075, \text{ or about } 75 \text{ in } 100,000.$$



(655) Since  $P\delta$  and  $P\varphi$  are independent, the probability of randomly selecting a group of sixteen females and seven males with the above-defined statural characteristics is even smaller:

$$\begin{aligned} P\delta\varphi &= (P\delta)(P\varphi) \\ P\delta\varphi &= (.00102)(.00075) \\ P\delta\varphi &= .000007 \end{aligned}$$

In other words, the odds are less than a million to one that the spectator is as short as 64 inches—Joseph Milteer's reported stature.

(656) For the sake of argument, it may be assumed that the 64-inch stature record of Milteer understates his true height by two inches, making him 66 inches tall. According to the survey cited above, about 85 percent of women and 20 percent of men are less than 66 inches in stature. Using the same approach detailed above, the probability is as follows:

$$\begin{aligned} P\delta\varphi &= (P\varphi_{16\leq 66''})(P\delta_{4\leq 66''\leq 7}) \\ P\delta\varphi &= (.0743)(.0334) \\ P\delta\varphi &= .0025 \end{aligned}$$

Stated as odds, the chances are about 25 out of 100,000 that the spectator was as short as 66 inches.

(657) By the same method it can be shown that the probability the spectator was at least 70 inches in height is 0.87. That is, the odds are about 9 to 1 that he was as tall as estimated from the street signs.

### *Conclusions*

(658) By two independent tests, it can be shown that the spectator alleged to be Milteer was substantially taller than the Milteer's reported height of  $64\pm 2$  inches. The first method provides a height estimate of about 70 inches through comparison with the reported dimensions of two street signs shown in the motorcade. The second demonstrates that the probability of the spectator's height falling within the range given for Milteer is statistically remote.

(659) The findings of both tests support the conclusion that the spectator was not Joseph Milteer.

### *(e) The three tramps*

#### 1. INTRODUCTION

(660) Immediately after the assassination, law enforcement officers conducted a search of the area behind the grassy knoll in which several railroad boxcars were situated. As a result of this search, approximately six to eight persons who appeared to be derelicts were taken either to the nearby Dallas County Sheriff's office, or to the Dallas Police Department for questioning. All were released without being booked, fingerprinted or photographed. (222) Among these "derelicts" were three men who, according to the arresting officers, had been found in a boxcar approximately one-half mile south of the assassination scene. (223) As the police led the three derelicts through Dealey Plaza to the sheriff's office, they were photographed by several press photographers. (224)

(661) When allegations of a CIA connection with President Kennedy's death emerged in the years following the assassination, these photographs received wide publicity in newspapers, television and in

the April 28, 1975 issue of Newsweek magazine. (225) It was claimed that two of the derelicts or "tramps," as they had come to be called, bore striking resemblances to Watergate burglars E. Howard Hunt and Frank Sturgis respectively. (226) Allegations have been made that Hunt, who had been a CIA employee in 1963, Sturgis, who, while not an employee, had been involved in CIA-related activities, had been together in Dallas on November 22, 1963 and had participated in the assassination as part of a CIA conspiracy. (227)

(662) In 1975 the Rockefeller Commission, investigating CIA activities within the United States and allegations concerning CIA complicity in the Kennedy assassination, requested the FBI to compare known photographs of Hunt and Sturgis, taken near the time of the assassination, with photographs of the tramps each was said to resemble. (228) After a photographic analysis of facial and statural characteristics of the men in question, the FBI concluded that "neither E. Howard Hunt nor Frank Sturgis appear as any of the three 'derelicts' arrested in Dallas, Tex., as shown in the photographs submitted."

(229) In response to the 1975 Newsweek story, the CIA also conducted a physiological comparison of the Hunt and Sturgis photographs with the tramp photographs, and reached the same conclusion as the FBI. (230)

(663) Nevertheless, Warren Commission critics still view this issue as unresolved and the identity of the three tramps is still regarded as an important part of the conspiracy theories. (231) In addition to the Hunt and Sturgis connection, three other individuals, Thomas Vallee, Fred Lee Chrisman, and Daniel Carswell, who have been named as possible co-conspirators, have been suggested as likely tramp candidates.

(664) In an attempt to identify or exclude Hunt, Sturgis and these other individuals as one of the derelicts arrested by the Dallas Police Department, forensic anthropologists were asked to examine and compare photographs of the tramps and the suspected individuals.

## 2. ISSUES

(665) Can any of these individuals be positively identified or excluded as one of the three tramps?

## 3. MATERIALS

(666) *Three tramps.*—A series of 8 by 10 black and white copy prints depicting one or more of the tramps were examined. (See figs. IV-50—IV-56.) These were taken by press photographers as the detainees were being escorted through Dealey Plaza by Dallas police officers. A number of enlargements of the heads of the three individuals were also provided.

(667) Photographs of the following individuals were examined and compared with those of the tramps:

(668) *Daniel Carswell.*—Two photographs, one an 8 by 10 black and white lateral view (1963) and the other a 3 by 3 color frontal view (1969), were reviewed.

(669) *Fred Lee Chrisman.*—The only available photograph was a single undated black and white 8 by 10 print.

(670) *E. Howard Hunt*.—Twenty-six black and white photographs that span the assassination period and vary widely in type, pose, and quality were examined.

(671) *Frank Sturgis*.—A series of 38 black and white photographs, ranging widely in quality and varying from casual snapshots to studio photographs, were studied. They are undated but, based upon the subject's age and clothing styles, they appear to span the period of the assassination.

(672) *Thomas Vallee*.—One 8 by 10 black and white frontal view was analyzed.

#### 4. CONCLUSIONS

(673) Daniel Carswell, E. Howard Hunt, Frank Sturgis, and Thomas Vallee were not the tramp(s) with whom they were being compared. Fred Chrisman strongly resembles one of the tramps, but, without analysis of additional photographic materials, no positive identification can be made.

#### 5. ANALYSIS

(674) The three tramps have been arbitrarily identified "A," "B," and "C" according to their position, from left to right, in figure IV-50. All three are white males of medium stature and physique. Tramp A appears to be approximately  $35 \pm 5$  years old, tramp B about  $30 \pm 5$  years, tramp C, the eldest, about  $50 \pm 10$  years. Tramp B is the tallest, exceeding A and C (who are of approximately equal height) by about 3 to 5 inches. None of the men have any striking facial abnormalities or disfigurements. Their hands, shown in several photographs, display no abnormalities or amputations that might serve as clues to identification. Judging from his apparent gait, tramp A may have been slightly bow-legged. Tramp C appears to have been somewhat splay-footed.

(675) All three men are shabbily dressed, befitting their apparent status as vagrants. Tramp A, however, is the better attired, wearing well-fitting jeans and a tweed-like sports jacket, although this, judged by 1963 styles, was several years out of date. Tramp B is wearing ill-fitting slacks and a double-breasted suit coat. Tramp C, from his battered fedora to his worn-out shoes, has managed to achieve a sartorial effect similar to what one would expect had he been fired from a cannon through a Salvation Army thrift shop.

(676) While such clothing might be a disguise, their footwear seems consistent with their classification as vagrants. All three men are shod in worn, low-cut oxfords that appear to be leather-soled. Tramp C's shoes seem to be several sizes too large for him.

#### *Tramp A*

(677) Enlarged photos of this tramp were compared with those of Thomas Vallee who, a few weeks before the assassination, had been arrested in Chicago after making threats on the life of President Kennedy, Frank Sturgis, the anti-Castro soldier of fortune who participated in some of the illegal activities associated with the Watergate scandals, and Daniel Carswell. (See fig. IV-57, JFK exhibit F-172).\*

\* Originally Sturgis was compared only with tramp B (see HSCA JFK hearings, vol. IV, pp. 374-77); the anthropologists were later asked to extend their comparison to include tramp A.



(678) Table I compares the facial indices of tramp A with those of Vallee, Sturgis, and Carswell. The figures enclosed in parenthesis along with indices of Vallee and Sturgis represent the difference between their indices and that of tramp A. Thus for the nasal index (No. 4), that of Vallee is 68, 3 points less than that of tramp A. This would suggest that Vallee had a slightly narrower nose (relative to its length) than that of the tramp. Nevertheless, when consideration is given to the possibility of variation in the index caused by the inevitable errors involved in taking measurements from the rather poor quality tramp photographs, such a difference is not too impressive. In contrast, the same index for Sturgis exceeds that of tramp A by 15 points, indicating that, compared to the tramp's his nose was much broader in relation to its length. This difference is considerable, and far outweighs any variation caused by technical error.

(679) When the differences in the other indexes of the series were similarly examined, it was determined that generally the values of Vallee's indices more closely approximated those of the tramp than the indices of either Sturgis or Carswell. Four of Vallee's indices differ by less than 5 points from tramp A's and the largest difference is 7 points. These results were indicative of a fair resemblance between Vallee and tramp A. Sturgis' indices vary between 2 and 15 points from those of the tramp. The average deviation of all seven indices is 4 for Vallee, 7 for Carswell, and 8.6 for Sturgis. Therefore, on the basis of metric analysis, Vallee's resemblance to the tramp is more impressive than that of either Sturgis or Carswell. An average deviation of 5 or less may be considered as evidence of a strong resemblance between the subjects of analysis.

(680) In addition to this facial index analysis, the subjects' morphological features were also closely examined. Strong differences in their features were discerned between those of tramp A and Vallee, Sturgis, and Carswell.

### *Sturgis*

(681) 1. *Hair*.—Both Sturgis and Tramp A have dark hair with a strong transverse wave. Tramp A's bilateral recession of the hairline, however, is more advanced than is observed on any of the Sturgis photographs. Sturgis also has a short, low part line extending from the apex of lateral hairline recession on the right side of the head—a feature not present in tramp A.

(682) 2. *Forehead*.—Tramp A's forehead is characterized by a strong vertical interciliary sulcus (frown line) that extends upward to a point about three-quarters of the distance between the level of his eyebrows and hairline. This sulcus is a little to the left of the midline of his forehead so that its lower end is located very close to the medial (inner) end of his left eyebrow. This wrinkle, of course, is probably somewhat accentuated by the tramp's deep frown. In several photographs of Sturgis shown in a similar facial expression, however, this deep furrow is not observed. Instead, Sturgis has a short, almost dimple-like, vertical interciliary line situated slightly to the right of the midline of the forehead.

(683) 3. *Eyebrows*.—The eyebrows of both men are similar in form (low, weakly arched). In the tramp, however, they are more narrowly separated than in Sturgis. In the former, they are heavy throughout

their length; in the latter, the lateral (outer) half of the eyebrows is scantily haired.

(684) 4. *Nasal form*.—Tramp A's nasal profile is straight, ending in a sharp and angular nasal tip. His nasal tip is horizontal or perhaps slightly depressed. Sturgis has a slightly convex nasal profile with a full, fleshy, and slightly elevated tip.

(685) 5. *Mouth*.—The Tramp has a relatively wide mouth with thin membranous lips. Each end of the mouth terminates in an oblique furrow (angulus oris sulcus). Sturgis' mouth is narrower with full lips; the angular furrows at the ends of the mouth are not as prominent as those of the Tramp.

(686) 6. *Chin*.—The chin of the Tramp is low, moderately projecting and has a relatively narrow, slightly squared lower border. Sturgis' chin is very deep, strongly projecting with an extremely wide, square, lower border. It is also distinguished by a well-marked median cleft—a feature not observed in the Tramp.

(687) 7. *Ears*.—The Tramp's ears are more projecting than those of Sturgis. The ear lobes of the Tramp are attached; Sturgis has free lobes. In the Tramp, the intertragal notch is extremely narrow, whereas in Sturgis, it is wide.

(688) 8. *Physique*.—Throughout the numerous series of photographs, Sturgis is characterized by a massive, muscular body build with some suggestions of a tendency toward corpulence. The Tramp, while well-muscled, is thin and wiry. In somatotypic terms, Sturgis would be classified as an endomorphic mesomorph; the Tramp as a mesomorphic ectomorph. Stated more plainly, Sturgis is built like a defensive guard, the tramp like an offensive quarterback. No statural data on either man was available but if it were assumed that they were of equal height, Sturgis would probably outweigh Tramp A by at least 20 to 40 pounds.

(689) To summarize, Frank Sturgis differs strongly from Tramp A in numerous metric and morphological features as well as in overall physique. Most of these features relate more to the underlying skeletal framework than to superficial soft tissues and, therefore, could not be effectively altered by disguise. For example, the massively squared, deep chin of Sturgis could not be altered into the low, more gracile chin of Tramp A. In conclusion, Frank Sturgis can be excluded as a candidate for the identification of Tramp A.

(690) *Vallee*.—As noted previously, Thomas Vallee resembles Tramp A more strongly in facial indices than Sturgis. There are also some similarities between the Tramp and Vallee in morphological traits. Thus, the contour of the hairline, the projection and general shape of the ears (except for the lobes) and the height and contour of the chin are much alike. Offsetting these resemblances, however, are the following features:

(691) 1. *Forehead*.—The strong vertical interciliary furrow of the Tramp is not present in Vallee.

(692) 2. *Eyebrows*.—These are laterally sparse in Vallee, but are heavy throughout in the Tramp.

(693) 3. *Mouth*.—Vallee has a small mouth, whereas the Tramp's is relatively wide. The upper lip is longer in Vallee. The angular furrows marking the corners of the mouth in the Tramp are not present in Vallee.



(694) 4. *Ears*.—The Tramp has attached lobes, Vallee's lobes are free.

(695) 5. *Nose*.—The strongest morphological differences between Vallee and the Tramp are in nasal structure:

(a) Nasal root—Very broad in Vallee, narrow in Tramp A.

(b) Nasal bridge—Wide, low, and concave in Vallee; narrow, salient and straight in Tramp A.

(c) Nasal tip—Rounded and extremely elevated in Vallee; angular and slightly depressed in Tramp A.

(d) Nostrils—In Vallee, the margins of the nostrils recede upward to such an extent that their interiors are fully exposed. This condition is sufficiently extreme to be classified as a disfiguring trait. The nostril margins are of normal configuration in Tramp A.

(e) In Vallee, two wart-like growths are present in the nasal region. The smaller is located just above the lower margin of the left nostril; the larger growth is on the cheek immediately adjacent to the margin of the left nostril. Neither feature is observed in the photographs of Tramp A, although the larger of these two structures is sufficiently sharp to allow visualization if it were present in the photograph.

(696) In conclusion, despite some strong metric resemblance between these two individuals, they are sufficiently dissimilar in morphological features to exclude Vallee as being Tramp A.

#### *Carswell*

(697) Of the three men who have been proposed as Tramp A, the resemblance between the latter and Carswell is the least impressive. As noted previously, they diverge in facial index values by an average of 7.0 points. Carswell's face is relatively long and narrow; Tramp A's is short and broad. This length difference is especially expressed in the lower face with Carswell's chin and upper lip being very long when compared to the Tramp's. Carswell's nose is also much longer, relative to its breadth. Differences in ear structure are also striking. In the Tramp, the lobes are attached whereas in Carswell the lobes are "welded"—that is, they attach to the sides of cheek with no discernible lobe at all. The antihelix of the ear (the elevated ridge just in front of and parallel to the outer margin of the ear) is well developed in Tramp A, but very poorly developed in Carswell.

#### *Tramp B*

(698) Photos of Frank Sturgis and Daniel Carswell\* were compared with those of Tramp B. (See Figure IV-58.) Table II compares the facial indices of Tramp B with those of Sturgis and Carswell.

#### *Sturgis*

(699) In terms of these indices, Sturgis most closely resembles Tramp B in mouth height relative to lower face height (No. 5), the length of his ear lobe relative to the total ear length (No. 6), and the total ear length relative to face height (No. 7). He is more divergent in the remaining indices. The average deviation between the six facial indices analyzed here is 4.0 points. This is low enough to

\*Originally, Carswell was compared only with Tramp A (see HSCA-JFK Hearings vol. IV, pp. 374-77); the anthropologists were later asked to extend their comparison to Tramp B.



make it impossible to rule out Sturgis on the basis of metric traits alone.

(700) The following morphological differences, however, between Sturgis and Tramp B indicate that they are not the same person:

(701) 1. *Hair*.—Sturgis is a very dark brunette with strongly waved hair; Tramp B has medium-dark hair with a slight wave.

(702) 2. *Hairline*.—The hairline of Tramp B shows more bilateral recession than is observed in Sturgis.

(703) 3. *Nose*.—Tramp B has a concave nasal profile with a rounded, slightly bulbous, nasal tip. Sturgis' nasal profile is slightly convex and the nasal tip is less bulbous than that of the Tramp.

(704) 4. *Chin*.—The most striking difference between the two men is the form of the chin. Sturgis' is massive and square; Tramp B has a small and rounded chin.

(705) 5. *Ears*.—Tramp B's ears are considerably more projecting than those of Sturgis which are rather close set.

(706) 6. *Physique*.—Tramp B appears to be considerably more linear in body build than Sturgis, who is broad and stocky in physique.

#### *Carswell*

(707) Carswell's resemblance to the Tramp based upon the facial indices was not nearly as impressive. Two of his facial indices, forehead height relative to total face height (No. 1) and lobe length relative to ear length (No. 6) differ from those of the Tramp by 12 and 13 points, respectively. These differences strongly exceed any divergence that might be introduced by technical error. The average deviation between the values of all six indices is 5.8 points. This deviation is sufficiently high to exclude Carswell as Tramp B on metric features alone.

(708) Strong differences in morphological features are also observed between Carswell and Tramp B. Carswell has a longer face relative to its breadth than the Tramp. Carswell's nose is thin with a sharply defined tip whereas the Tramp has a short, relatively broad nose with a rather bulbous tip. Carswell has a longer chin than the Tramp. The most striking difference between the two men is in the shape of their ears. Carswell's are essentially lobeless, that is, the lower margins of the ear attach directly to the cheek; Tramp B has well-developed lobes. In Carswell, the antihelix (the elevated ridge just in front of and parallel to the outer margin of the ear) is very weakly developed; in the Tramp, this structure is strongly developed and prominent.

(709) In conclusion, both Carswell and Sturgis can be excluded as being Tramp B.

#### *Tramp C*

(710) Photographs of Fred Lee Chrisman, a right-wing activist implicated in the Garrison investigation, and E. Howard Hunt, a principal figure in the Watergate burglaries and an employee of the U.S. Central Intelligence Agency at the time of the Kennedy assassination, were compared with Tramp C. (See fig. IV-59.) The indices of Hunt, Chrisman, and Tramp C are compared in table III.

(711) In comparing Hunt with Tramp C, the average difference in the six indices of the two men is 9.0, a value sufficiently high to suggest no particularly strong resemblance in facial proportions. In addition, in comparing the photographs of the Tramp to those of Hunt taken in

the late 1950's and early 1960's, the following morphological differences were noted:

(712) 1. *Forehead*.—Tramp C has several well-developed transverse frontal sulci and a strong vertical interciliary sulcus. These are not observed in Hunt who, even in photographs taken in later years, has only slightly developed transverse frontal and interciliary furrows.

(713) 2. *Nose*.—The Tramp has a relatively broad nose with a bulbous, fleshy nasal tip. The nasal tip is not depressed. Hunt has a narrow nose with a salient nasal bridge and an angular, moderately depressed nasal tip.

(714) 3. *Mouth*.—Tramp C has thick, full membranous lips; Hunt is thin-lipped.

(715) 4. *Cheek*.—Tramp C has well-developed nose-labial folds whereas in Hunt these are only incipiently developed in his photographs taken at about the time of the assassination.

(716) 5. *Ear*.—From his photographs, it is apparent that Hunt underwent surgery to correct his rather projecting ears. The date of this operation was not determined but from the photographs, it would appear to have been within a few years before or after the assassination. In degree of projection, the Tramp's ears appear to more closely match Hunt's pre-surgical condition.

(717) Two features not influenced by the surgery are strongly different in the two men. One of these is the helix, the fold of flesh that forms the outer rim of the ear. In the Tramp, this fold is wide and prominent whereas it is narrower and more weakly developed in Hunt. The second difference is in the antihelix, the secondary fold that roughly parallels the helix inside the ear. This structure is strongly developed in the Tramp and, in fact, its lower portion appears to extend beyond the helix. In Hunt, the antihelix is weakly developed.

(718) 6. *Scars*.—In the Tramp there is a pit-like, ovoid scar about 1 centimeter in diameter located immediately above the lateral end of his right eyebrow. This feature is not observed in any of the Hunt photographs provided for examination.

(719) 7. *Age*.—In general facial tone, age lines and other features, Tramp C appears to be at least a decade older than Hunt.

(720) From the observed differences in metric and morphological features, E. Howard Hunt can be confidently excluded as being Tramp C.

(721) *Chrisman*.—A comparison of a single undated full-face photograph of an individual identified as Fred Lee Chrisman was also made with those of Tramp C. His mouth is slightly open and he appears to have been speaking at the time the photograph was made. The subject is a white male who appears to be about  $60 \pm 5$  years of age. In general, the index difference between Chrisman and Tramp C is low, ranging between two and six points with a mean difference of four index points. This is less than one-half the average index difference (nine) observed between E. Howard Hunt and Tramp C. Such a low value suggests a strong resemblance between Tramp C and Chrisman in general facial configuration.

(722) Tramp C appears to be approximately a decade younger than Chrisman.\* The similarities in morphological traits between Tramp C and Chrisman are nevertheless impressive.

\*Therefore, to obtain a more definitive interpretation, it would be helpful to establish the date of the Chrisman photograph.



(723) 1. *Hairline*.—Although Tramp C is wearing a hat, it is positioned far enough back on his head to reveal his hairline. It appears to be continuous and uninterrupted by a part or any strong recession due to balding. It is thus of the same general configuration observed in Chrisman.

(724) 2. *Forehead*.—Both Chrisman and Tramp C are characterized by several strongly developed transverse frontal sulci "worry lines". These are more accentuated in Chrisman as would be consistent with his apparent greater age. Unfortunately, these wrinkles are not shown with sufficient clarity in the Tramp to allow a detailed comparison of their pattern. Differences observed in this region include the circular, pit-like scar located immediately lateral to the outer end of the left eyebrow of Tramp C and the strong vertical inter-ciliary sulcus of the Tramp, neither of which are discernible in the Chrisman photograph.

(725) 3. *Eyebrows*.—In both men, the eyebrows are low and weakly arched. In the Tramp, however, they appear to be more widely separated than they are in Chrisman.

(726) 4. *Eyes*.—Both men have heavy medial eyefolds which tend to obscure the upper lids, lending their eyes a "hooded" aspect. Also both display well-developed oblique palpebral sulci that gives them a somewhat "baggy-eyed" appearance.

(727) 5. *Nose*.—In Tramp C, the nasal root appears to be somewhat broader than in Chrisman. In both men, the lower nasal region is characterized by a full, fleshy tip.

(728) 6. *Mouth*.—Both men have relatively small mouths. The membranous portion of Chrisman's upper lip appears to be extremely thin whereas that of the Tramp is moderately full. The nasolabial fold is strongly developed in Tramp C but not present in Chrisman.

(729) 7. *Chin*.—Both men have prominent chins with squared lower margins. In both, platysmal folds have developed to give them a rather "jowly" appearance.

(730) 8. *Ears*.—No morphological inconsistencies in the ears of the two men are observed.

(731) In brief, Chrisman resembles Tramp C rather strongly in both metric and morphological features. These similarities, derived from the analysis of a single undated photograph of Chrisman, are in no way sufficient to establish a positive identification. Nevertheless, they are strong enough to suggest that further analysis, based on more fully documented Chrisman photographs, should be considered, unless independent evidence excludes Chrisman's presence in Dallas on November 22, 1963.

TABLE I.—COMPARISON OF FACIAL INDICES OF TRAMP A WITH THOSE OF VALLEE, STURGIS, AND CARSWELL

No. and index (Times 100)	Tramp A	Vallee	Sturgis	Carswell
1. Forehead height: Total face height.....	31	37 (6)	33 (2)	28 (3)
2. Nose length: Lower face height.....	47	46 (1)	33 (14)	42 (5)
3. Chin eminence height: Lower face height.....	20	23 (3)	31 (11)	27 (7)
4. Nose breadth: Nose length.....	71	68 (3)	86 (15)	76 (5)
5. Mouth height: Lower face height.....	33	34 (1)	40 (7)	36 (3)
6. Lobe length: Ear length.....	22	29 (7)	30 (8)	42 (20)
7. Ear length: Total face height.....	36	29 (7)	33 (3)	30 (6)
Mean deviation.....		4.0	8.6	7.0



TABLE II.—COMPARISON OF FACIAL INDICES OF TRAMP B WITH THOSE OF FRANK STURGIS AND DANIEL CARSWELL

No. and index (times 100)	Tramp B	Sturgis	Carswell
1. Forehead height: total face height.....	41	33 (8)	28 (13)
2. Nose length: Lower face height.....	40	33 (7)	42 (2)
3. Chin eminence height: Lower face height.....	27	31 (4)	27 (0)
4. Nose breadth: Nose length.....	38	40 (2)	36 (2)
5. Mouth height: Lower face height.....	30	30 (0)	42 (1)
6. Lobe length: Ear length.....	36	33 (3)	30 (6)
7. Ear length: Total face height.....			
Mean deviation.....		4.0	5.8

TABLE III.—COMPARISON OF FACIAL INDICES OF TRAMP C WITH THOSE OF E. HOWARD HUNT AND FRED LEE CHRISMAN

No. and index (times 100)	Tramp C	Hunt	Chrisman
1. Forehead height: Total face height.....	29	42 (13)	33 (4)
2. Nose length: Lower face height.....	35	46 (11)	41 (6)
3. Chin eminence height: Lower face height.....	20	30 (10)	18 (2)
4. Mouth height: Lower face height.....	40	50 (10)	34 (6)
5. Lobe length: Ear length.....	30	32 (2)	27 (3)
6. Ear length: Face height.....	36	28 (8)	33 (3)
Mean deviation.....		9.0	4.0

PHOTOGRAPHS TAKEN OF THE THREE TRAMPS  
ARRESTED IN DEALEY PLAZA, NOVEMBER 22, 1963



FIGURE IV-50.



FIGURE IV-51.



FIGURE IV-52.



FIGURE IV-53.





FIGURE IV-54.



FIGURE IV-55.



FIGURE IV-56.

TRAMP A



VALLEE



CARSWELL

FIGURE IV-57.



STURGIS



TRAMP B



FIGURE IV-58.

HUNT



TRAMP C



CHRISMAN

FIGURE IV-59.

(f) *The "Second Oswald" Theory—Comparison of Oswald Facial Photographs*

#### 1. INTRODUCTION

(732) Various conspiracy theories have centered around the hypothesis that a double of Lee Harvey Oswald played a part in the assassination of President Kennedy. The theorists themselves appear to disagree on the origin and role of this "Second Oswald." Nevertheless, all agree that in at least one stage of his career between the

time Oswald defected to the Soviet Union and the assassination, he was impersonated by a double. (232) To investigate this possibility, the anthropology consultants examined a series of Oswald photographs ranging in time from his Marine Corps enlistment to his arrest in Dallas after the assassination.

## 2. ISSUE

(733) Is there any photographic evidence of an Oswald imposter?

## 3. MATERIALS

(734) The collection of photographs pertaining to the Kennedy assassination and Warren Commission investigation includes several dozen of Oswald (or, possibly, his double). As one might expect, they vary widely in pose, facial expression, lens-subject distance, and image quality. From these, it was possible to select nine in which (1) the facial features were fairly well defined, (2) the pose was either nearly full-face or true profile, and (3) represented the subject during various key episodes of his life from the time he was a Marine until the assassination. (See figs. IV-60, IV-61, JFK exhibits 556-557.)



FIGURE IV-60.





FIGURE IV-61.

In addition, two photographs of definitely poorer quality were selected for analysis. These were two of the controversial "backyard photographs;" they differ from the others in that the direction of lighting was from almost directly overhead and the facial image was somewhat more poorly defined. (See figs. IV-18 and IV-20.)

(735) In addition to the Oswald photographs, data were included from three photographs of Billy Lovelady, taken in the early 1960's. Lovelady was a fellow employee of Oswald's at the Texas School Book Depository and his strong physical resemblance to Oswald was a source of controversy and confusion regarding the "man in the doorway" photograph.\* The inclusion of Lovelady's facial indices in our analysis provides a convenient control or yardstick to measure the variation observed in the facial indices derived from the Oswald photographs.

#### 4. METHODS

(736) This analysis is based on 15 indices derived from 16 measurements of the head and face.\*\* The measurements were taken to the nearest 1 millimeter from 8-by-10-inch, black-and-white enlargements of the subject's face. The indices for both Oswald and Lovelady are given in table I. There are some missing values for the three profile views of Oswald. This is because certain measurements necessary for calculating these indices cannot be obtained from a profile photograph. Also, a few indices could not be calculated for the full-face photographs because lighting, image clarity, or other factors would not permit the necessary measurements to be made with sufficient accuracy.

\*See par. 759 *infra*.

\*\*See addendum A, pars. 746-748 *infra*.

(737) In order to reduce this complex set of individual values to more meaningful statistics, one of the methods long employed by anthropologists was used to compare both living and fossil populations. The method selected was Penrose's distance statistic, which has an advantage over more sophisticated multivariate methods in that it is fairly simple to compute, but still gives an acceptable approximation of the morphological differences between the groups. (233) The use of more elaborate methods did not seem justified in view of the small sample sizes involved.

(738) This method reduces a set of complex variables that characterize two or more groups to a pair of coefficients that reflect the groups' overall difference in size and shape.

(739) To apply this method to the present problem, the index data was grouped chronologically to represent Oswald at various significant periods of his life:

1. Marine Corps.
2. Russia.
3. Backyard (Dallas).
4. New Orleans.
5. Arrest (Dallas).

(740) The data were then studied to determine whether the face of the individual shown in the Oswald photographs, taken during any one of the first four of these periods (Marine Corps, Russia, backyard, New Orleans), differed morphologically from the face of the man who was arrested in Dallas after the assassination. If such a difference was found, it might suggest that a double was involved.

## 5. CONCLUSIONS

(741) There are no biological inconsistencies in the Oswald photographs examined that would support the theory that a second person, or double, was involved. The variation observed is that expected in an array of photographs taken by different cameras with varying lens, camera angles, lighting, and other technical differences.

(742) It is not, however, possible totally to dismiss the "second Oswald" hypothesis on the basis of this negative finding. For example, it is possible that a double—if one existed—may not have been included in the series of photographs examined. There is also a possibility, however remote, that such a double was such a perfect twin of Oswald that no detectable metric or morphological differences are discernible in the photographic record.

## 6. ANALYSIS

(743) The results of the analysis are shown in the accompanying graph. (See fig. IV-62.) The origin of the graph represents the facial indices of the Dallas arrestee. The various points on the graph represent the other Oswald photographic sets as well as that of Billy Lovelady. The points were determined by plotting the Penrose size coefficient against the shape coefficient. The closer a point falls to the origin, the greater the similarity in facial morphology between the individual represented in a particular set of photographs and the person arrested in Dallas. As might be expected, the point representing Billy Lovelady lies much farther from the origin than those represent-

ing Oswald. Of the latter, the backyard photographs are the most divergent.

(744) Compared to Lovelady, who strongly resembles Oswald, the Marine, Russia, backyard, and New Orleans photographs cluster rather closely to the origin. It seems highly probable that the relatively small deviation observed in the Oswald data can be attributed to inevitable error involved in locating landmarks and making measurements from the photographs rather than to the existence of an Oswald double.

(745) In addition to the analysis of facial indices described above, other facial features were compared. For example, in the three profile views, the angle of the nasal bridge in relation to the face was  $37^{\circ}$  in all three cases and the angle between the nasal septum and the facial plane varied by less than  $1^{\circ}$ . The ears are relatively distinctive in shape and are strikingly similar in all photographs where they can be examined. The hairline, if one makes allowance for the passage of time, is quite compatible in all photographs examined. Also, there was no evidence of any incompatible anomalies, scars or other characteristic features suggesting different individuals in the various photographs.



TABLE I.—FACIAL INDICES OF LEE HARVEY OSWALD AND BILLY N. LOVELADY

Index No.	MMT	Marine	Russia			Backyard			New Orleans			Dallas arrest			Lovelady		
			1	2	3 <sup>1</sup>	1	2	3 <sup>1</sup>	1	2 <sup>1</sup>	3 <sup>1</sup>	1	2	3 <sup>1</sup>	1	2	3
1	9/1	55.3	68.1	69.7	---	70.1	74.7	---	68.5	---	---	68.7	---	---	65.8	---	65.4
2	9/2	85.2	83.9	86.8	---	83.7	85.0	---	83.5	---	---	84.8	---	---	75.8	---	68.0
3	3/2	36.5	33.9	29.7	---	32.6	30.0	---	33.0	30.4	---	34.1	---	30.7	36.4	32.4	32.0
4	4/5	43.7	41.3	42.0	42.0	---	---	---	36.1	37.8	---	42.0	---	39.1	38.1	32.6	26.2
5	14/5	20.0	22.6	22.1	20.2	---	---	---	22.9	20.3	---	21.6	---	21.9	26.5	28.3	29.4
6	11/9	90.8	87.2	86.1	---	86.6	86.8	---	90.8	---	---	85.7	---	---	86.0	---	100.0
7	15/4	75.0	82.7	74.0	---	---	---	---	79.2	---	---	---	---	---	79.3	---	---
8	8/2	23.5	24.1	24.2	25.3	26.5	25.0	---	24.2	23.5	---	23.4	25.0	---	24.2	28.5	28.0
9	8/5	33.7	36.0	33.6	34.9	40.0	37.0	---	36.1	32.4	---	35.2	34.4	---	37.2	42.2	41.2
10	12/11	87.6	90.2	---	---	77.5	---	---	89.8	---	---	87.5	---	---	---	---	85.3
11	16/6	32.4	34.2	33.3	---	31.2	30.8	---	32.1	---	---	---	---	---	40.2	47.8	46.1
12	7/6	33.8	34.2	---	---	40.6	---	---	33.9	---	---	34.1	---	---	37.0	41.1	46.1
13	10/11	24.7	24.4	24.9	---	---	---	---	21.7	---	---	23.9	---	---	27.9	29.1	26.5
14	13/12	30.8	32.4	---	---	40.0	---	---	32.2	---	---	32.1	---	---	---	---	48.3
15	6/2	32.2	31.2	30.8	6.0	32.6	32.5	---	30.8	34.3	---	31.1	---	35.2	27.7	26.5	26.0

<sup>1</sup> Profile.

TABLE II.—MEAN INDEX VALUES OF LEE HARVEY OSWALD AND BILLY N. LOVELADY

Index No.	Oswald					Lovelady	Mean	Standard deviation
	Marine	Russia	Backyard	New Orleans	Dallas arrest			
1-----	65.3	68.9	72.4	68.5	66.1	65.6	67.8	2.71
2-----	85.2	85.4	84.4	83.5	85.6	71.9	82.7	5.33
3-----	36.5	31.8	31.3	31.7	33.6	33.6	33.1	1.95
4-----	43.7	41.8	-----	36.9	42.3	32.2	39.4	4.76
5-----	20.0	21.6	24.2	21.6	22.3	28.1	23.0	2.86
6-----	90.8	86.6	86.7	90.8	85.9	93.0	89.0	2.94
7-----	75.0	78.4	-----	79.2	73.5	81.6	77.5	1.46
8-----	23.5	24.5	25.8	23.8	23.9	26.9	24.7	1.34
9-----	33.5	34.8	38.5	34.2	35.1	40.2	36.1	2.63
10-----	87.6	90.2	77.5	89.8	87.3	85.3	86.3	4.66
11-----	32.4	36.8	31.0	32.1	30.0	44.7	34.5	5.51
12-----	33.8	34.0	40.6	33.9	32.0	41.4	36.0	3.99
13-----	24.7	24.4	-----	21.7	23.5	27.8	24.4	2.22
14-----	30.8	32.4	40.0	32.2	33.4	48.3	36.2	6.76
15-----	32.2	32.7	32.6	32.6	32.8	26.8	31.6	2.37

TABLE III.—Measurements used to derive indices for comparison of Oswald photographs

1. Total head height-----Vertical distance from the top of the head to the bottom of the chin (*vertex* to *menton*.) N.B.: some allowance for hair must be made in taking this measurement from a photograph.
2. Physiognomic face height---Distance from the midpoint of the hairline to the most anterior point on the lower forehead just above the nasal root depression (*trichion* to *glabella*).
3. Forehead height-----Distance from the midpoint of the hairline to the most anterior point on the lower forehead just above the nasal root depression (*trichion* to *glabella*).
4. Nose length-----Distance from the deepest point of the nasal root depression to the junction point between the nasal septum and the upper lip (*subnasion* to *subnasale*).
5. Total face height-----Distance between the most anterior point on the lower forehead just above the nasal root depression and the lowest point on the chin (*glabella* to *menton*).
6. Ear length-----Distance between the uppermost point on the helix of ear and the lowermost point on the earlobe (*superaurale* to *subaurale*).
7. Lobe length-----Distance between the lowest point in the intertragic notch and lowest point of the earlobe (*inter-tragion* to *subaurale*).
8. Mouth height-----Distance from the point of contact between the upper and lower lip and lowest point on the chin (*stomion* to *menton*).
9. Maximum head breadth----Horizontal distance across the broadest portion of the head. N.B.: Some allowance for hair must be made in taking this measurement from a photograph.
10. Interpalpebral breadth----Horizontal distance between the inner corners of the eyes (*biendocanthion* breadth).
11. Facial breadth-----Maximum horizontal distance across the face (*bizygomatic* breadth).
12. Mandibular breadth-----Horizontal distance between the angles of the jaws (*bigonal* breadth).
13. Chin width-----Horizontal distance across the eminence of the chin.
14. Chin eminence height-----Distance from the point of deepest depression between the lower lip and chin and the lowest point on the chin (*supramentale* to *menton*).

TABLE III.—*Measurements used to derive indices for comparison of Oswald photographs—Continued*

15. Nasal breadth-----Maximum horizontal breadth across the nasal wings (*bialar breadth*).  
 16. Lateral ear projection-----Horizontal distance from the lateral-most point on the outside margin of the ear to the junction of the ear with the face.

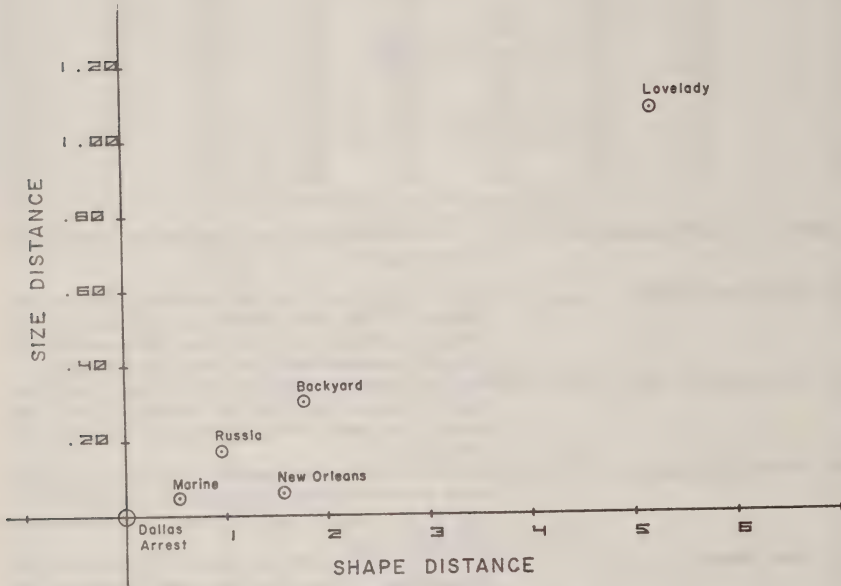


FIGURE IV-62.—Penrose Size and Shape Coefficients Calculated From Facial Indices of Lee Harvey Oswald and Lovelady Photographs. Origin of the Graph Represents Dallas Arrest Photographs.

## ADDENDUM A

### CALCULATION OF PENROSE SIZE AND SHAPE COEFFICIENTS

(746) Table I gives the individual indices calculated from the measurements taken from the photographs of the series under examination. These were averaged for each photographic set to give the mean indices shown in Table II. In some instances these are, of necessity, based on a single value. The mean and standard deviation of the index values of the photographic sets (including Lovelady's) were then computed. These statistics are also given in Table II.

(747) The index values were then converted to standard deviation units (*d*-values). The Penrose coefficients were calculated from the *d*-values, using the following formulae:

Distance coefficient:

*Formula*

Size

$$C_Q^2 = \left\{ \sum^n (d) \right\}^2 / n^2$$

Shape

$$C_s \cdot \frac{n-1}{n} = \sum_1^n (d^2) / n - \left\{ \sum_1^n (d) \right\}^2 / n^2$$



(748) The size and shape coefficients calculated for the various photographic sets and plotted in Table I are as follows:

	Marine	Russia	Backyard	New Orleans	Lovelady
Size equals $C^2 Q$ -----	0.049	0.172	0.303	0.060	1.07
Shape equals $C^2 z \times \frac{14}{15}$ -----	.480	.888	1.647	1.460	4.83

## ADDENDUM B

### OSWALD HEIGHT AND PROPORTION STUDIES\*

#### INTRODUCTION

(749) Several Warren Commission critics have alleged that substantial differences exist in the reported heights and facial characteristics among different photos and other measurements purported to represent Lee Harvey Oswald. (234) For example, differences of as much as 2 inches in height exist between an early Marine Corps induction photograph of Oswald in front of a height chart (see fig. IV-63, JFK exhibit 15-166), reported height measurements of Oswald, (235) measurements of the Oswald corpse in Dallas, and another height chart photograph of Oswald (see fig. IV-64). The Marine photograph, which allegedly depicts Oswald with a 13-inch head (measuring from the bottom of his chin to the top of his head), is also said to be inconsistent with his true facial measurements. (236) (See fig. IV-63). On this basis, it has been alleged that these differences are evidence of different individuals purporting to be Lee Harvey Oswald. (237)

#### 1. ISSUE

(750) Are the differences in Oswald's body measurements, as detected from photographs of him standing against a height chart, probative in any way of an Oswald imposter theory?

#### 2. ANALYTICAL APPROACH

(751) Two members of the photographic evidence panel were directed to take an independent series of photographs involving an individual of known height standing against a height chart. For each series of pictures, each person was to be photographed at different distances in relation to the height chart. The vertical orientation of the camera and its distance to the height chart was also subject to change at the photographer's discretion, but the camera was kept essentially horizontal at all times so that optical axis was level, that is, parallel to the ground.

(752) In addition, the forensic anthropologists on the photographic evidence panel were asked to provide information concerning discrepancies between measured and reported heights.

\* This section was prepared under the direction of W. K. Hartmann and C. W. Kirk. For related testimony of Kirk, see HSCA-JFK Hearings, vol. IV, pp. 62-65.

## 3. CONCLUSION

(753) No probative weight should be given to an Oswald imposter theory based upon differences in Oswald's body measurements that have been detected from photographs of him standing against a height chart.

## 4. ANALYSIS

(754) First, panel member Dr. William K. Hartmann made a series of photographs of a subject standing with a height chart in the background, but with the subject standing at two different distances from the chart (shoulder-to-chart distance, 1 inch and 10 inches) and the camera at two distances typical of identification camera working distances (45 inches and 58 inches, respectively, from the height chart). To simulate the typical practice of adjusting the camera to the subject's approximate facial height (sometimes to eye level, sometimes to nose level, et cetera), the camera was elevated and lowered through a series of different vertical positions from chin level to the top of the hair. It was found that the subject's height, read from the height chart, ranged from 0 to  $1\frac{3}{4}$  inches higher than the actual measured hair-top position during these photos. (238)\*

(755) A second test involving similar procedures was conducted by Sergeant Cecil W. Kirk, of the District of Columbia Metropolitan Police Department's mobile crime lab, using departmental identification camera and height chart equipment. The subject's height in this experiment, as read from the height chart, increased one-half inch as the subject moved from a position with heels against the wall to a position with heels 8 inches out from the wall. In addition, while the height of the subject's head actually measured 8 inches from chin to head top, the readings on the height chart were approximately  $12\frac{1}{2}$  and 14 inches, thereby resulting in errors of  $4\frac{1}{2}$  and 6 inches, respectively. (239) (See fig. IV-65, JFK exhibit F-564.)

(756) The types of discrepancies obtained in the Hartmann and Kirk studies are attributable to parallax errors which, in this case, present a difference in scale between the images of the subject and the chart. Parallax errors occur because the plane of the subject's face or body is not in the same plane as the height chart to which it is being compared; since these two planes were photographed from a finite distance, nonparallel lines from camera to subject were introduced. The nonparallel lines diverge from the camera lens to the subject. Consequently, from a camera centered in front of the subject's face, the line of sight from the camera lens slopes upward past the top of the subject's head, yielding a higher reading on the background wall chart than the actual head-top height.

(757) Moreover, unless the subject photographed is standing with his back against the height chart at a correct distance from a properly

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\*In addition, because this particular subject's driver's license reported his height as  $1\frac{3}{4}$  inches smaller than his actual measured hair-top position during the photography, the total discrepancy between the height chart readings and the driver's license ranged from  $1\frac{3}{4}$  to  $3\frac{1}{2}$  inches. The reported height in the subject's driver's license was not checked until after the photography had been completed.

positioned camera equipped with an appropriate lens,\* it is unreasonable to assume that the resulting picture is ever a precisely accurate indicator of both his height and head size. (240) For this reason, height charts are no longer commonly used in law enforcement and industrial security work. (241)

(758) Finally, the photographic evidence panel's board of forensic anthropologists advised that a diurnal variation in height of half an inch or more is common during the course of a day, with the subject generally being taller in the morning when the spine has been less compressed. (242) The board also cited to the panel an anthropological study by Robert M. White and Edmund Churchill ("The Body Size of Soldiers," U.S. Army Natic Laboratories, technical report 72-51-CE, 1971), which measured heights of 6,682 army personnel versus the heights these individuals reported for themselves. Typical discrepancies in height were 1.1 inches. Generally, men of average height (5 feet 9 inches) reported themselves 1.1 inches taller than their measured stature; relatively short men reported themselves about 0.8 inch taller; and relatively tall men reported themselves 1.2 inches taller.

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\* To get an accurate height measurement, the camera must be level and its optical axis must be level with the top of the head.





FIGURE IV-63.



FIGURE IV-64.—New Orleans arrest picture of Oswald in front of height chart.

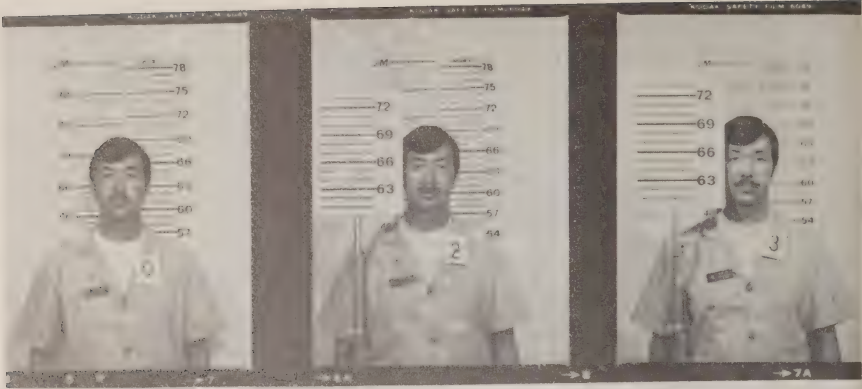


FIGURE IV-65.

(g) *Comparison of photographs of Lee Harvey Oswald and Billy Nolan Lovelady with that of a motorcade spectator*

#### 1. INTRODUCTION

(759) A widely publicized photograph taken by Associated Press photographer James W. Altgens within a few seconds after President Kennedy was first shot shows a spectator who bears a strong physical resemblance to Lee Harvey Oswald standing at the west end of the Texas School Book Depository entranceway. (See fig. IV-66, JFK exhibit F-559.) Altgens has stated that he took the picture of the presidential limousine, with the Texas School Book Depository entranceway in the background, just after he heard a noise "which sounded like the popping of a firecracker." (243)

(760) In evaluating the evidence that Oswald was in the sixth floor, southeast corner window of the Texas School Book Depository at the time of the shooting, the Warren Commission considered the allegation that the man shown in the doorway in the Altgens photograph was Oswald. The Commission concluded that the spectator was not Oswald, but rather another Texas School Book Depository employee, Billy Nolan Lovelady. (244) This conclusion was based upon Lovelady's identification of himself in the Altgens photograph (245) and upon statements of other persons who were present in the Texas School Book Depository entranceway at the same time. (246)

(761) Warren Commission critics have charged that there was insufficient basis for this conclusion (247), and have faulted the Commission for presenting " \* \* \* no supporting visual evidence by which one can appraise the resemblance between Lovelady and the man in the doorway, or Lovelady and Oswald, although nothing less hangs on the accurate identification of the doorway man than Oswald's possible total innocence of the assassination" (248).

(762) This issue has also persisted because of reported discrepancies in connection with the clothing worn by the Altgens figure and Billy Lovelady on November 22, 1963. (249) In media prints of the Altgens photograph, the man appears to be wearing a long-sleeved shirt similar to the one in which Oswald was arrested. (250) (See fig. IV-67.) According to a memo written by FBI Director J. Edgar Hoover



to the Warren Commission after Lovelady had been interviewed and photographed in 1964 by FBI agents, (251) Lovelady was reported to have been wearing a short-sleeved red and white, vertically striped shirt. (See fig. IV-67.) Lovelady later explained that when he was interviewed and photographed by the FBI, he had not been told to wear the same shirt he had worn on the day of the assassination and that, in fact, he had been wearing a long-sleeved, plaid shirt when he was standing in the Texas School Book Depository doorway. (252) (See fig. IV-67.)



FIGURE IV-66.—TSBD doorway spectator seen in Altgens 1-6 photograph taken on Elm Street.

## SPECTATOR IN TSBD DOORWAY:



Oswald Arrest Shirt



(Hughes Film)

Lovelady in Dealey  
Plaza Nov. 22, 1967  
(Martin Film)Lovelady in 1963  
shirt (1976)

(Altgens Photo)



(Bell Film)

Lovelady photo-  
graphed by FBI  
in 1964

FIGURE IV-67.—Photographic evidence evaluated in Robert Groden's shirt analysis.

(763) This contradiction was partially resolved by photo-optical work performed by Robert Groden, a Warren Commission critic and photographic consultant to the committee.\* During his work with the committee Groden made photographically enhanced enlargements of the original 35 millimeter black and white Altgens negative and frames of the Bell, Martin, and Hughes color motion picture films, which also showed the spectator in the doorway, and detected a pattern of lines that correspond in pattern and color more closely to Lovelady's plaid shirt than to Oswald's tweed-patterned shirt. (253) (See figure IV-67.)

(764) Even so, in an effort to resolve the issue even more definitively, the photographic evidence panel's board of forensic anthropologists were requested to study the photograph of the spectator shown standing in the doorway.

## 2. ISSUE

(765) Is it possible to identify positively as either Lee Harvey Oswald or Billy Lovelady, the man, shown in the Altgens photograph standing by the doorway entrance to the Texas School Book Depository at the time of the President's assassination.

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\* Groden initially was among those who claimed the Altgens photograph could not be of Lovelady. See note 249 *supra*.





FIGURE IV-68.—Enlargement of spectator's face.  
Altgens A.P.—World Wide Photos



FIGURE IV-69.—Oswald arrest in Dallas.

### 3. MATERIALS

#### *Spectator*

(766) In order to produce the clearest possible photographic images of the spectator in question, the Photographic Evidence Panel had black and white prints made from the original Altgens 35 millimeter negative at various contrasts, density levels and enlargements.\* (254) They included various enlargements of the spectator's face such as that shown in figure IV-68. The anthropologists were furnished with a number of these prints.

#### *Oswald*

(767) A series of photographs of Lee Harvey Oswald, ranging from the time of his U.S. Marine Corps enlistment in 1956 to his arrest in Dallas in 1963, were provided to the anthropologists. While all were examined, those taken on the day of Oswald's arrest in Dallas received the closest scrutiny. (See, for example, Figure IV-69).

\* The Altgens negative was not subjected to digital image processing because the image was blurred to the resolution limitations of the camera system, and, consequently, the Photographic Evidence Panel believed that computer assisted enhancement techniques would not aid in identifying the man in the doorway.

*Lovelady*

(768) Photographs of Lovelady were furnished which varied in date from 1959 to 1977. Of most interest were those taken near the time of the assassination. (See, for example, figure IV-70.)



FIGURE IV-70.—Billy Nolan Lovelady circa 1959-63.

#### 4. CONCLUSION

(769) Due to the blurred quality of the enlargements of the spectator's image in the Altgens photograph, it was not possible either to identify or exclude positively Lovelady or Oswald. Based on a subjective assessment of the facial features of the spectator, however, it was determined that the man in the doorway bears a much stronger resemblance to Lovelady than to Oswald. Thus, assuming it is either Oswald or Lovelady, and not a third party, it appears highly improbable that the spectator is Oswald and highly probable that he is Lovelady.



## 5. ANALYSIS

(770) In comparing the photographs of Oswald and Lovelady, the general similarities in facial configuration between the two men were initially noted. Closer examination of the photographs revealed significant differences in the two men's facial proportions:\*

(771) (a) *Facial length*.—Relative to facial breadth across the cheekbones, Lovelady's face is longer than Oswald's.

(772) (b) *Lower jaw breadth*.—Relative to facial breadth, measured across the cheekbones, Lovelady's lower jaw is narrower than Oswald's.

(773) (c) *Chin length*.—Relative to facial length, Lovelady has a somewhat longer chin than Oswald.

(774) (d) *Forehead breadth*.—Relative to the breadth of the face measured across the cheekbones, Lovelady's is broader than Oswald's.

(775) (e) *Nasal breadth*.—Relative to nose length, Lovelady's nose is broader than Oswald's.

(776) (f) *Nasal tip*.—Oswald's nasal tip is somewhat small and sharply contoured, whereas that of Lovelady is rounder and more bulbous.

(777) (g) *Forehead height*.—Due to hairline recession, Lovelady has a relatively higher forehead than Oswald.

(778) (h) *Hairline contour*.—Photographs of Lovelady and Oswald taken at a time close to the assassination indicate that overall Lovelady's central hairline had receded more than Oswald's, resulting in Lovelady's higher forehead, as noted above; in addition, the recession on both sides of Lovelady's temple is more sharply advanced than Oswald's. Lovelady's recession was not uniform, and he has a downward projection in the hairline about one inch to the right of the center of his forehead. This eccentrically placed "widow's peak" was not observed in any of Oswald's photographs.

(779) In summary, Lovelady's face is relatively longer than Oswald's, its length accentuated, in part, by more advanced balding and also by his narrower lower jaw and deeper chin. The asymmetry in his hairline is also a distinctive trait.

(780) The enlargements of the spectator's face are not of sufficient quality to permit accurate measurements. However, several features corresponding to Lovelady's traits can be discerned and subjectively assessed:

(781) (a) A relatively broad, high forehead;

(782) (b) Advanced recession of the hairline on each side of his head;

(783) (c) Interruption of the central hairline by a downward extension located slightly to the right of the center of the forehead;

(784) (d) A relatively long face with narrow jaws and a deep chin;

(785) (e) A rather bulbous nasal tip.

\*All measurements relative to these facial proportions are provided in the tables accompanying the text to pars. 732-748 supra.

(786) COMMENTS ON THE PANEL'S REPORT BY ROBERT GRODEN, CONSULTANT TO THE COMMITTEE

PREFACE

Robert Groden, a critic of the Warren Commission and coauthor of *JFK: The Case for Conspiracy*, was a photographic consultant to the committee. In this capacity, he provided background information on the issues that have been raised by the critics in the area of the photographic evidence; he also provided technical assistance to the committee in the area of photography. As such, he made an important contribution to the work of the committee. Though not a member of the committee's photographic evidence panel, he also gave panel members an extensive briefing on the prior work that had been done on various photographic issues; he also had additional input to the panel's work, either through communications with committee staff working with the panel or through participation in panel discussions. As a consultant to the committee, Groden was given access to the work of the photographic evidence panel and asked that the committee publish his comments on the panel's report.

The committee believes that Groden's views should be part of the record, although in including them, the committee or the panel do not endorse them. In addition, the committee noted some errors and misunderstandings in terms of the panel's work that should be borne in mind. By way of example, Groden was unaware that the frame of the Nix movie film corresponding to Zapruder frame 313, which shows the fatal head shot, had been digitally scanned, and that the photographic evidence panel had in fact been asked whether President Kennedy showed a reaction to a bullet prior to Zapruder frame 190. With respect to the work of the panel, Groden was also apparently unfamiliar with some procedures (that is, why only original materials were relied upon for enhancement and analytical purposes) and with the basis for some panel decisions (that is, why it attached little weight to the fact that the Kennedy autopsy photographs were taken with 1963 film). The general issues that Groden addresses in his comments, particularly in the area of the photographic evidence, are also addressed in the panel's report.

015086

January 3, 1979

The Honorable  
Chairman Louis Stokes  
Select Committee on Assassinations  
U. S. House of Representatives  
Washington, D. C. 20515

Dear Sir:

Enclosed please find the formal dissenting view dealing with the work of the Committee's scientific medical and photographic panels and my report on related photographic materials which I feel were inadequately covered in the public hearings.

As a photographic consultant to the Committee, I feel that these views should be expressed for the record and for history. I will be including photographic materials relating to the various reports herewith enclosed.

Sincerely,

  
Robert J. Groden

### I. THE "BACKYARD" PHOTOGRAPHS

Among the areas in which I disagree with the way the photo evidence was presented and treated, was using only Jack White's arguments in the area of the Neely Street photographs. You were all aware that some of the arguments presented were no longer issues and that some of them never really were. The true issues were not accurately dealt with in the hearings. These were the discrepancy of the head to body size as well as the height-to-rifle length ratio and the visual retouching of the skin and surrounding area. At the July 19 panel meeting I didn't argue the point because of my desire to attend the rest of the meetings. But in my opinion no matter what the panel members concluded, the backyard photographs are beyond question fakes. Disregarding all of the other evidence supporting the fact of forgery, the visual areas of retouching cannot be easily dismissed.

For the record, the method used here was, almost without doubt, simply posing a man (or possibly different men for each photograph) in the backyard with the rifle, pistol and publications as part of this original picture. The only item added was the head of Lee Oswald from the middle of the chin up. The argument that all of the backgrounds are the same is, I feel, impractical and the same goes for the idea of adding the shadows after the fact.

In spite of the fine work Jack White has done on the rifles, I don't believe using him alone to present "all of the issues" dealing with the Neely Street photographs can ever be justified.



## II. THE NIX AND MOORMAN PICTURES

Dr. Hunt's "analysis" of the Moorman No. 2 Polaroid photograph and the Nix film were in extreme error and the questioning insufficient to accurately deal with these items.

The best versions of the Moorman No. 2 Polaroid are the prints made from either of the original high resolution negatives in the possession of UPI and AP. Dr. Hunt didn't even see, scan, or study them. He used the original print which faded 15 years ago. You can hardly see the President in the foreground, and images in the background have long since nearly vanished including the "assassin" behind the retaining wall on the grassy knoll, the man behind the stockade fence and other shapes which raise questions as to others on the knoll. The man who appears in Willis No. 5 and the Zapruder film is clearly seen behind the wall in the Moorman No. 2.

Also overlooked is the fact of the Western-most wall edge changing shape depending on which negative was used to create any given specific point.

The first Moorman print on the other hand is not now as was originally described by all who saw it before the FBI confiscated it. It has now lost the sixth floor, which was there originally in the photograph as well as the eastern end of the TSBD and the "assassin's" window.

I intended to present evidence that as was the case with the Neely Street photographs, the Moorman pictures as they exist now are fakes. For instance, Mary Moorman took three consecutive photographs. The committee looked at the first and the third of the three and they both show evidence of retouching. None of this was dealt with by Dr. Hunt. Hunt couldn't see the man behind the wall because he no longer appears in the original print. His entire image has faded to white.

As for the Nix film, Hunt couldn't see a gunflash because the frame corresponding to Zapruder frame No. 312 was not scanned and is the only frame showing the flash. This is the frame just before the head explosion frame. It is doubtful that Dr. Hunt would even know where to look for the muzzle flash even if he had had the correct frame since we have had no interaction at all on this matter.

## III. THE WALKER BULLET

The shot taken at General Walker was referred to several times during the public hearings as being fired by Oswald. This is a terribly misleading assumption.

It is still questionable whether the Mannlicher-Carcano can be linked to Oswald. But even if it was his, it could not have fired the "Walker bullet." Oswald's alleged rifle fired 6.5-mm ammunition, copper jacketed, while the Walker bullet was a steel jacketed 30.06.

Oswald has never been linked with another rifle during that period of time.

## IV. TIMING AND NUMBER OF SHOTS

Although testimony given at the time of the public hearings would lead one to believe that it was the general consensus of the photographic panel that the timing and number of the shots had been established

and that there was little question as to this conclusion, this was of course not the case. The vote was as presented split, but the ballot was not clearly defined. No one was asked if they thought a shot struck before Zapruder film frame number 190, nor were they asked if they felt shots struck both before and after the road sign.

One important result of that panel meeting was my discovery of a shot fired in the mid-to-late 150's of the Zapruder film.

Seven years ago, I discovered that President Kennedy was responding to a shot that missed by frame 158. But at the panel meeting I found that by frame 163, Governor Connally was also responding to the sound of the same shot. This coupled with the overall timing of the shot sequence of the police tape gives us a whole new perspective of the shot timing.

In the face of the current evidence it seems that this is the actual timing and firing order of the shots:

1. From behind. Missed. Fired in the 150's. Possibly hit the concrete by the manhole cover on the south curb of Elm Street, or the pavement on Elm Street. (There is Warren Commission testimony of this.)

2. From the front. Hit the President in the neck. Penetrated deep within the President's body and was removed during the autopsy by Commander Humes. (See FBI receipt for the bullet.) Struck the President between frames 188 and 189.

3. From behind. Struck the President in the back, 4 inches below the shoulder line to the depth of an inch or an inch and a half and did not traverse the body. This bullet probably fell out of the President's body either during the time the body was in Parkland Hospital or while enroute to Bethesda for the autopsy. Upon striking the President in the back, the transfer of momentum pushed the President forward and downward by several inches. This is one of the few occurrences on film that can be accurately measured but has gone totally overlooked by the photo panel. The hit occurs at frame 227, and the forward motion lasts for over a half dozen frames.

4. From behind. Hit Governor Connally in the back. There are two possible times for this hit. The first is at frame 227 when the Governor's right arm spins toward his left. The second occurs at frame 238 when there is a violent drop to the Governor's right shoulder and his cheeks puff out, his hair becomes disheveled. There is an outside possibility that these two pronounced movements may represent separate shots. The first to Connally's right wrist and the second to his back with either striking his left thigh.

## V. JOSEPH MILTEER

The matter of Joseph Adams Milteer is by no means put to rest by comparing the height of the man in the Altgens photo to Milteer's known height or the unknown relative heights of the other people in the crowd standing near him.

If the man in the crowd is Milteer it is just the icing on the cake. You have the Miami tapes as well as the Miami police reports and the FBI files on Milteer. He is strongly involved in both the Kennedy and King cases. He is proof of a conspiracy and that the FBI and



Warren Commission participated in an active collaborated coverup by burying all of the Milteer evidence in the National Archives and never mentioning his name even once in the Warren Report or the 26 volumes of evidence. Milteer is a prime suspect in both the John Kennedy and Martin Luther King murder plots.

Resting the Milteer case on the height of the crowd man would be a gross error in judgment.

## VI. THE ACOUSTICS TESTS

There seems to be a problem in the way the acoustics tests were done:

1. Only two firing points were considered for acoustical matching—the "Oswald window" and behind the stockade fence. By using the audio signals and echo patterns from only these two points, the testing machinery could eliminate any other shot, echo pattern or sound below the dB threshold used, related to shots from behind the retaining wall, the southern knoll, the Dal-Tex building, the Records building, other depository window or the roof, or any other possible firing point from its final conclusions thereby destroying the use or value of the tests.

2. By not removing the new overhead road signs and replacing the old Stemmons Freeway sign, new elements are introduced that will alter the results of the tests and eliminate from consideration possible shot sounds and echo patterns altered by these new elements.

3. Different ammunition was used in the testing. First, older ammunition of the type allegedly used by Oswald was used. Then, newer ammunition was used that gave a different sound even audibly to the witnesses and the testing machinery is far more sensitive than the human ear to such changes.

In spite of the many inconsistencies in the testing procedure, there was still evidence of a possible four shots from at least two different directions.

It must be noted here that the first acoustical tests done on the Dallas police tape found very strong evidence of at least seven shots which is confirmed by the visual and concrete evidence at the time of the assassination.

## VII. REPORT ON ISSUES RELATING TO THE AUTHENTICITY OF THE AUTOPSY X-RAYS AND PHOTOGRAPHS OF PRESIDENT JOHN F. KENNEDY

During the public hearings in September, witnesses from the committee's scientific panels stated that in their opinion the autopsy photographs and X-rays of President Kennedy were genuine, citing such evidence as the fact that the film used was produced in 1963.

The importance of the photographs and X-rays cannot be overestimated. Every scientific panel—photographic, medical, acoustic ballistics, N.A.A., et cetera—all depend upon the autopsy materials for their testing and conclusions.

The basic conclusions from all except the acoustics panel is that two shots struck the President from behind.

On the surface it would seem that the autopsy materials bear out this conclusion. That, however, may not be the case.



There is evidence that raises grave questions about the authenticity of the items being relied upon by the select committee and its panels. Moreover, there is medical data in the photos and X-rays which is apparently being ignored.

# 1. THE PROBLEM OF AUTHENTICITY

The fact that the HSCA panels have been unable to establish inauthenticity of these items may not reflect their authenticity but rather the skill with which they were forged.

In considering the matter of authenticity of some of the autopsy photographs, my main concern is that of the large head exit wound and its exact and general location as described by the vast majority of trained medical personnel at Parkland Hospital and reported by many of the Dallas witnesses. The main issue here is that such a wound may have been photographically eradicated from the only visual record of the President's body following the assassination via the simple technique of photo-compositing. If done with care, this would be undetectable.

On this point, some of the photo panel's tests would be meaningless. For example, one test the panel claims proves authenticity is that the film in evidence was manufactured in 1963. It seems that if any one were to plot the forging of these pictures that they would not wait until the film used in the other (genuine) autopsy photographs would be out of date, and that they would certainly use the same film that would have been originally used in the entire autopsy series. All this test proves is that the forgeries could have been produced in late 1963 or early 1964.

For the record, my visual inspection of the autopsy photographs and X-rays reveals evidence of forgery in four of the photographs: Color chromes No. 42 and No. 43 showing the rear of the head and No. 15 and No. 16 which appear to be the same shots in black and white (made from black and white duplicate negatives of No. 42 and No. 43).

Within the circumference of the President's head, there is an irregular line. Within this line the hair appears black and wet. On the outside of the line it is auburn and completely dry. In later generations of these photographs, a large degree of contrast buildup becomes apparent at the line's edge and the line becomes clearly defined. This phenomenon is characteristic of crop lines in matte insert processes used for retouching and repositioning of photographs.

It is my opinion that these two photographs are forgeries, composites manufactured to eliminate evidence of an exit wound in the rear of the President's head. The only method I am aware of that could have been used to create these composites is known as "soft edge matte insertion." (See attachment 1.)

The question of the authenticity of these particular photographs is crucial because of the large volume of evidence indicating that at least one shot struck the President in the head from the front, causing an exit wound at the rear of the skull. The problem is that this wound, seen by so many in Dallas, does not appear in the autopsy photographs and X-rays.

The most reliable descriptions were those from the Parkland doctors on the day of the murder. Doctors Clark, Jones, Perry, Baxter, Akin,

McClelland, and Nurses Hutton, Bowron, and several others all describe that same wound in great detail, and all place it at the same point in the rear of the President's head in the area of the occipital bone. Many said cerebellar tissue protruded from a large avulsive exit wound. This too indicates a lower rear head exit wound. A partial list of the many eyewitnesses who describe this wound is included as attachment 2 to this memo. It seems highly improbable that all these witnesses were mistaken.

Furthermore, the descriptions of the eyewitnesses who saw Kennedy's head wound at Parkland are corroborated by those who saw the bullet impact upon the head in Dealey Plaza.

Secret Service Agent Clint Hill saw a piece of the President's skull fly from the President's head and travel toward the rear-left of the car. Mrs. Kennedy attempted to pick up this piece (and indeed from a recently declassified portion of her Warren Commission testimony we can see that she may have picked up a section of skull) and tried to hold it onto the rear of her husband's head.

The next day Billy Harper found a piece of bone in Dealey Plaza. Originally, the "Harper" fragment was identified by a qualified pathologist as a section of occipital bone.

In addition, there is photographic evidence of a shot exiting from the rear of the President's head.

Zapruder film frames No. 335 and No. 337 clearly show the result of the head shot. They are the clearest two frames showing the President after the head explosion.

I have examined and measured the contours of the President's head on Zapruder film frames 335 and 337. The rear of the President's head, in these frames, shows his hair pushed upward and away from the scalp. That indicates the bones underneath were avulsed outward. This matches the description of the wound provided by Dr. McClelland who said the bones at the rear of the head were "sprung open." (See attachment 2 for full quote and other descriptions of this wound.)

### *Conclusions*

The Dallas observations indicating a rear exit hole cannot be easily dismissed. These accounts were provided by trained medical personnel. It defies belief that so many people, viewing the President from different angles at different times, should all describe the same wound condition and position. My own examination of the autopsy photographs of the rear of the head shows a sharp contrast buildup along an irregular line at the rear of President Kennedy's head. This contrast buildup could be the result of a photocompositing process whereby another photograph was superimposed on the back of President Kennedy's head, thus eliminating evidence of that exit wound. Based upon my observation of that contrast buildup, and the Dallas medical observations indicating there was a wound there, it is my opinion, as a photo-consultant to the House select committee, that these photographs are forgeries.

### 2. LEFT TEMPORAL WOUND

There are at least two Parkland Hospital doctors who noted a wound of entry in the President's left temple. (Dr. Robert N. McClelland and Dr. Marion T. Jenkins)



Dr. McClelland, in his official statement regarding the assassination filled out at 4:45 p.m. on November 22, wrote: "The cause of death was due to massive head and brain injury from a gunshot wound of the left temple." (WR, p. 527) Dr. Jenkins, in his testimony to the Warren Commission on March 25, 1964, stated that "\* \* \* I thought there was a wound on the left temporal area, right in the hairline and right above the zygomatic process." (H6, p. 48) When informed that no one else had noted such an entrance wound, Dr. Jenkins stated that it might have been blood from some other point.

My examination of this area on autopsy photograph No. 29 leads me to believe that Dr. Jenkins was correct on his initial opinion.

Close inspection of the left temporal area on the original transparency (but not on any of the later generation duplicates) reveals the presence of a faint but distinct circular hole which I estimate to be approximately 5 or 6 mm in size in the left sideburn approximately 25 to 30 mm above the bottom of the sideburn, and 10 to 15 mm in front of the foremost ear line. (Photos 30 and 31 show much the same area but because of different exposure and clarity of the film, the hole shape is not as evident.)

The other photographic and medical panel members who inspected the autopsy items were not familiar with the Kennedy case and the question of a left temporal wound prior to and at the time of their examination of these items and so were probably not looking in that area for any damage.

I must point out that on transparency No. 29, the "hole" is visibly very faint with no blood to highlight it to the casual observer. Indeed, if one did not know to look for evidence of this wound, it would simply remain unnoticed.

To facilitate future study, I have made a single 8 x 10 glossy print of this area which is at the Archives stored with the original collection. (I made two such photographs: One was not clear because the transparency moved while in the enlarger.)

On July 19, 1978, while Dr. Michael Baden was at the Archives examining the X-rays and photographs, and I was attending a meeting of the photo panel, I telephoned Dr. Baden and informed him of the existence of this evidence of a left temporal bullet wound. While still on the telephone with me, Dr. Baden examined the photographs. He said he could locate no wound in the left temple, and that what I was seeing was "a small spot of blood." From this conversation, I could have concluded that either: (a) Dr. Baden was looking at a blood spot at another point close to the "hole"; or (b) Baden and I both saw the same thing in the left temporal area, but simply disagree as to what it meant.

On October 27 I had another opportunity to examine the X-rays and photographs and, on that occasion, I noted again that there was no blood visually related to this wound, raising further question of Dr. Baden's diagnosis. At that time I also discovered that the skull X-rays contained data which seem to indicate a hole in the left temple.

On lateral X-rays of the skull, there is a gray spot at the same location as the "hole" on photo No. 29. There is, however, no evidence of radiating fracture marks on the skull from this point.



### *Conclusion*

There is photographic and X-ray evidence supporting the observations of the Dallas doctors—McClelland and Jenkins—that there was a left temporal entrance wound.

I feel it is the committee's obligation to have the medical panel re-examine the X-rays and photographs, in the area I have pinpointed, and, if they disagree with my conclusion, explain what this circle represents, if not a bullet hole, and also explain the corresponding image on the X-rays.

### VIII. RECOVERED BULLET DURING JFK AUTOPSY

Although there is a great deal of evidence that a bullet was recovered from President Kennedy's body at the time of the autopsy, none of the evidence of this bullet was ever mentioned in the public hearings.

To recap, Warren Commission document No. 371 reveals "one receipt from the FBI for a missile removed during the examination of the body." An examination of the receipt shows that a bullet was removed from the body of President Kennedy during the autopsy in the evening of November 22, 1963. This bullet was handed over to and signed for by FBI agents Francis X. O'Neill and James W. Sibert.

The January 4, 1964, issue of the *Journal of the American Medical Association* (vol. 187 No. 1) stated on page 15 that the bullet was recovered during the autopsy.

The *Washington Post* of December 18, 1963, after checking the report with the FBI before publication, stated that a bullet was recovered from deep within the President's shoulder. This was again confirmed in the *Post* on May 29, 1966.

The fact of the recovery of this bullet fully destroys the myth of the "single bullet," and that evidence of an additional gunshot during the assassination was suppressed.

Commander Humes removed this bullet but there is no indication from which direction the bullet came. If it was from the front, there had to be at least two assassins. If the bullet came from behind and as the best evidence will show, did not exit the President's body, considering the number and timing of the shots in any combination, there had to be more than one assassin.

The issue has been raised that the bullet or missile may have been a fragment of a bullet or missile. This seems highly unlikely since Sibert and O'Neill were professional enough to know the difference between an entire bullet and a small fragment. In addition to this, the FBI itself did confirm to the *Washington Post* that it was "a bullet" and not just a fragment.

It should be noted that this entire area of discussion occurred many months before the single bullet theory was invented to try to prove the "lone assassin theory."

### ATTACHMENT 1: SOFT EDGE MATTE INSERTION

Given the present nature of these photographs, the only method that I am aware of that could have been used to alter them is called soft edge matte insertion.

The technique uses a black and white masking process and this is how it works:

An original 4 x 5 photograph; that is, transparency would be taken showing the rear of JFK's head with the exit wound in the center (in this case two, No. 42 and No. 43). Using one at a time, it is pin registered and placed in a photographic enlarger along with a pin registered piece of 4 x 5 black and white film called a registered black core matte. This is clear film with a black center in a specific area over the area on the original transparency to be eliminated. The clear fades quickly to the black, not a sharply defined edge, hence the term "soft edge."

This "sandwich" is then projected onto another piece of 4 x 5 Ektachrome transparency film. In this case the result so far would be the rear of the President's head with a large blank, black area in the rear. This new piece of film is then put in a light tight container.

At this point, another transparency of the back of another head, this one with an entrance bullet hole and hair that matches J.F.K.'s head photographed to the same size, is pin registered with a clear core matte which is a piece of black film tapering to a clear center. This is a contact film print of the black core matte and fits exactly in register with the original transparency and the black core matte.

This new "sandwich" is then projected in register onto the partially exposed Ektachrome. Now the photograph is complete.

The final result is what appears to be the rear of the President's head with a small wound of entry near the top. The same thing is done to the other original in register and the result is a pair of virtually undetectable forgeries of the finest possible quality. The technique would allow the integrity of stereo views.

#### ATTACHMENT 2: REFERENCES TO AN OCCIPITAL HEAD WOUND OF EXIT IN WARREN REPORT (PART OF CE 392, APPENDIX VIII, PP. 516-530)

Kemp Clark—"Two external wounds, one in the lower third of the anterior neck, the other in the occipital region of the skull, were noted." (p. 517) "There was a large wound in the right occipitoparietal region \* \* \* both cerebral and cerebellar tissue were extruding from the wound" (p. 518).

Charles Carrico—"Dr. Jenkins attempted to control slow oozing from cerebral and cerebellar tissue via pads instituted" (p. 520).

Malcolm Perry—"A large wound of the right posterior cranium was noted \* \* \*" (p. 521).

Charles Baxter—"\* \* \* the right temporal and occipital bones were missing and the brain was lying on the table \* \* \*" (p. 523).

Kemp Clark (handwritten at 4:15 p.m.)—"There was a large wound beginning in the right occipital extending into the parietal region" (p. 525).

M. T. Jenkins—"There was a great laceration on the right side of the head (temporal and occipital) causing a great defect in the skull plate \* \* \* even to the extent that the cerebellum had protruded from the wound" (p. 530).

Dr. John Ebersole (taped interview with Gil Delaney, Lancaster Intelligencer-Journal) + (a.), March 8, 1978—"knew shot came

from the back or side because the back of his head was blown off." (Ebersole now says he was misquoted.)

In an interview with Art Smith, Chester, Pa., Ebersole said the back of the skull was intact "except for maybe three small fragments."

Dr. Ronald Jones—"What appeared to be an exit wound in the posterior portion of skull" (6H56).

Dr. Perry—"A large avulsive injury of the right occipital area (6H11).

Dr. Charles Baxter—"A large gaping wound in the back of the skull \* \* \* literally the right side of his head was blown off" (6H 40-41).

Dr. McClelland—"As I took the position at the head of the table \* \* \* I was in such a position that I could very closely examine the head wound, and I noted that the right posterior portion of the skull had been blasted. It had been shattered apparently, by the force of the shot so that the parietal bone was protruded up through the scalp and seemed to be fractured almost along its posterior half, as well as some of the occipital bone being fractured in its lateral half, and this sprung open the bones that I mentioned in such a way that you could actually look down into the skull cavity itself and see that probably a third or so, at least, of the brain tissue, posterior cerebral tissue and some of the cerebellar tissue had been blasted out" (6H33).

Nurse Pat Hutton—"Pressure bandage was no use \* \* \* because of the massive opening on the back of the head."

Dr. Gene Akins—"Back of the right occipital parietal portion of his head was shattered, with brain substance protruding" (6H65).

Dr. Clark—"\* \* \* examined the wound in the back of the President's head. This was a large, gaping wound in the right posterior part, with cerebral and cerebellar tissue being damaged and exposed" (6H20).

Dr. Peters—"We saw the wound of entry in the throat and noted the large occipital wound" (6H71).

Diana Bowron—Parkland Hospital nurse.

[Warren Commission testimony follows:]



## BOWRON, DIANA - TESTIMONY before Warren Commission

These are some of the most relevant excerpts from the testimony of Parkland hospital nurse Diana Bowron who was the first trained medical person to observe the President upon arrival at Parkland hospital and observed the President face down in the car. She looked directly at the wound of exit in the rear of the President's head.

## TESTIMONY OF DIANA HAMILTON BOWRON

The testimony of Diana Hamilton Bowron was taken at 2:05 p.m., on March 24, 1964, at Parkland Memorial Hospital, Dallas, Tex., by Mr. Arlen Specter, assistant counsel of the President's Commission.

Mr. SPECTER. And what, in a general way, did you observe with respect to President Kennedy's condition?

Miss BOWRON. He was moribund—he was lying across Mrs. Kennedy's knee and there seemed to be blood everywhere. When I went around to the other side of the car I saw the condition of his head.

Mr. SPECTER. You saw the condition of his what?

Miss BOWRON. The back of his head.

Mr. SPECTER. And what was that condition?

Miss BOWRON. Well, it was very bad—you know.

Mr. SPECTER. How many holes did you see?

Miss BOWRON. I just saw one large hole.

Mr. SPECTER. Did you see a small bullet hole beneath that one large hole?

Miss BOWRON. No, sir.

Mr. SPECTER. Did you notice any other wound on the President's body?

Miss BOWRON. No, sir.

Mr. SPECTER. And what action did you take at that time, if any?

Miss BOWRON. I helped to lift his head and Mrs. Kennedy pushed me away and lifted his head herself onto the cart and so I went around back to the cart and walked off with it. We ran on with it to the trauma room and she ran beside us.

And an excerpt from a newspaper article labeled as "Bowron exhibit No. 3. in Warren Commission volume #19.

Miss Bowron, who was trained at Hope Hospital, Salford, said: "I realised who the man in the car was as soon as I saw Jackie Kennedy. Mr. Kennedy was slumped forward in his seat—and so was Mr. Connally.



Robert J. Groden  
Photo Consultant, H.S.C.A.

### ATTACHMENT 3: SUSPECTED FIRING POINTS IN THE ASSASSINATION OF PRESIDENT JOHN F. KENNEDY, AS THEY RELATE TO THE PHOTOGRAPHIC EVIDENCE

There are nearly 2 dozen suspected firing points in Dealey Plaza that have been raised by Warren report critics through the years. Of these, several are worthy of close inspection for they may be candidates as probable sources of shots within the plaza. Some of the 2 dozen:

1. The TSBD easternmost sixth floor window facing south (the "Oswald" window).
2. The TSBD roof.
3. The TSBD seventh floor.
4. The TSBD fourth floor, third pair from the left (west) end.
5. The TSBD westernmost pair of sixth floor windows facing south.
6. The Dal-Tex building second floor.
7. The Dal-Tex building third floor.
8. The Dal-Tex building upper floor (any of the top three).
9. Dal-Tex roof.
10. The county records building roof.
11. The county records building second floor.
12. The stockade fence on top of the "grassy knoll".
13. The cement retaining wall in front of the stockade fence.
14. In front of the cement structure on the knoll at the end of the stockade fence (northeastern end).
15. The railroad overpass.
16. A storm drain at the north curb of Elm Street.
17. The "umbrella man".
18. The "south knoll" (the grassy knoll on the south side of the plaza on Commerce Street).

Nos. 1 thru 11 were to the President's rear, 12 thru 16 were to his right front, 17 started at the front and ended to the rear as the car passed by, and 18 was to the President's left front.

1. Was almost certainly a firing point. If the "Oswald" window was used during the assassination, whether by Lee Oswald or any one else (this remains to be proven), it is logical to assume that there would be from this window. This would be consistent with a prearranged scenario as well with the official version of the crime. The film taken by Charlse Bronson may show a dummy snipers nest for a cover story being constructed just 7 minutes before the shots were fired.

2. and 3. are possible alternatives to 1 but with far less opportunity for interruption by a bystander as was always a possibility at the "Oswald" window. There were reports of a rifle being found at 2 and 3 was not even searched.

4. Is considered by Dr. Cyril Wecht because of the angle of bullet trajectory from that point.

5. Is the point where witness Arnold Rowland saw two men with a rifle just before the assassination but thought that they were Secret Service agents. There was also what appeared to be a bullet mark on the north sidewalk of Elm Street (since removed) that lined up with this window.

6. Because of a photograph taken by A.P. photographer, James Altgens, seeming to show a rifle shaped object protruding from the second floor window of the Dal-Tex building, several Warren report critics (including myself) felt that this was probably a firing point for one or two of the shots. The committee has made available to me the original Altgens negative. Using my technique of vario-density cynexing, I was able to enhance the image in the window to the point of clarity where the figure in the window is now identifiable as a black man leaning on the window sill with both hands, and with no gun in view.

7. Has been charged as a firing point for the same reason as window 6. Using the VDC technique. I feel that the window was closed and I can find no evidence of any shots from that window.

8., 9. and 10. are strong interchangeable possibilities for one or two of the shots from the rear. Either President Kennedy's or Governor Connally's back wounds or the President's rear entering head wound. These angles are much closer to the alleged trajectory (rear to front) than the depository points 1 to 5.

11. Only one man, Hugh McDonald, has mentioned this as a firing point. Logistically, it simply could not have been. The angles and line of sight won't line up to any traceable shot.

12. The committee's acoustic panel has presented corroborative evidence to support the photographic evidence that this was in fact a firing point. A figure can be seen in both the second Moorman Polaroid photograph (clearly showing a figure in the area directly behind the stockade fence, 8 feet to the left of the corner of the fence), and the closing few dozen frames of the Zapruder film also seem to show a figure in the same spot. Independently, the sound tapes from the stuck transmitter place a firing point in this exact position, as do a great deal of eye and ear witnesses to the shooting.

13. Appears in a long list of films and photographs: (a) the fifth Phil Willis slide; (b) the Hugh Betzner photo corresponding to Willis No. 5; (c) the Abraham Zapruder film frames in the area surrounding and including No. 413; (d) the Orville Nix film in shadow near the left edge of the retaining wall; and (e) the Marie Muchmore film for one frame at the extreme top of the frame.

After the shooting, a large crowd of spectators chased this man, who some thought was a gunman, back into the parking lot where he disappeared, and where a man with false Secret Service identification was encountered. In items a and c, a shape appearing to be a weapon or rifle-shaped object is noted being held by this man. The HSCA photo panel has determined that this is indeed a human shape.

14. Appears in the Orville Nix film for an entire sequence and can be seen in motion. Stereo pairs show this shape to have three dimensions, and to be in the plaza in front of the concrete structure with the "left arm" portion extending beyond the edge of the wall. There are similar patches of light and shadow visible on the wall in the next sequence that give the impression that this shape was only shadows. It was not. These remaining shadows lack the coloring and texture of the image itself.

15. There is no photographic evidence of an assassin at this point.

16. There is no photographic evidence of an assassin at this point.

17. It seems unlikely that a shot could have come from this point.



18. Two Dallas doctors noted an entrance wound in the President's left temple. I have also noted in autopsy photograph No. 29 and the front view X-ray that there seems to be such a bullet wound in evidence. If there was, then this probably came from the area of the southern grassy knoll. The only photographic evidence of a shot from this point is the Cancellare photograph. It shows a shape that appears to be a man holding what appears to be a rifle on top of the knoll near a tree just seconds after the shots were fired. However, this shape is far too vague to be considered proof of a gunman and must be considered with its limitations.

It is my opinion that Nos. 1, 9, 10, 12, 13, and 18 are the most likely candidates for firing points as well as either 2, 3, 4, 5, or 8 (one of these).

It is also my opinion that only four of the above or at the most five are truly candidates for firing points and that No. 14 was a probability who never fired a shot. The rest on the list I cannot believe to be points where shots came from on the basis of photographic evidence as well as other physical evidence.

ATTACHMENT 4: MEMO—ROBERT J. GRODEN TO JANE DOWNEY  
SUBJECT—THE CHARLES BRONSON FILM

FEBRUARY 25, 1979.

Earlier this year, I inspected and optically enhanced the regular 8-mm color motion picture of the assassination of President John F. Kennedy taken by Mr. Charles Bronson. There are four scenes of importance in this film:

1. Before the motorcade arrived, approximately 7 minutes before the shooting.
2. The motorcade on Main Street.
3. The motorcade on Houston Street.
4. The motorcade on Elm Street showing the President at the moment of the head explosion.

During the moments before the President arrived in Dealey Plaza, a bystander experienced an "epileptic seizure" and an ambulance was summoned. While the ambulance was present on Houston Street, Mr. Bronson filmed 8 seconds of footage from his position at the southwest corner of the Main-Houston intersection. He was standing on a pedestal near the corner, and his camera was running at 12 frames per second to preserve film (instead of the usual 18 fps).

At the upper left corner of the film frame for this entire sequence, Mr. Bronson photographed the two easternmost pairs of windows of the sixth floor of the Texas School Book Depository, including the window that Lee Oswald was supposed to be in at that moment.

Close inspection and optical enhancement reveals definite movement in at least two and probably three of the windows in question. The two most obvious are the same two windows (Nos. 1 and 3) that show movement in the Robert Hughes film at the beginning of the actual firing sequence. Also, the Hughes and Bronson films both show the man in window No. 1 to be wearing a bright reddish shirt (or so it appears) and the man in window No. 3 to be wearing a neutral-colored shirt.

The man in window No. 1 is moving rapidly back and forth, and the man in No. 3 seems to be crouched down at the window and rocking on his toes in much the manner of a baseball catcher.

The shape in window No. 2 is slightly less distinct than the other two. I originally felt that this "man" was actually the man in window No. 1 leaning back and forth, probably moving boxes around to construct what would later be called "the sniper's nest."

I now feel that this is a distinctly different person who is probably handing boxes to man No. 1.

As you know, I was sorry to hear the wording of the representative of the photo panel who testified that the moving shapes in these windows could not be identified as human one way or another from the Hughes' film. The fact that the shapes are indeed moving and stereo views show them to be well within the windows but not in as far as the boxes in the background, and that there is nothing else that these shapes could possibly be except human movement, should at least have prompted the wording to allow for a fairer comprehension on the part of another party concerned with the issue at a later date as is now the case of the Bronson film. When the subject was first raised as to the men in the windows, the press quoted the panel as stating that the Hughes film showed no one in the windows. This was not the case. So I would suggest the wording in any analysis of the Bronson film to be more exacting.

I am delighted to learn of the computer work that Mr. John Sigalos, the attorney for Mr. Bronson is going to have done independently, and I suggest another look at the Hughes' film.

ATTACHMENT 5: MEMO—ROBERT J. GRODEN TO JANE DOWNEY

SUBJECT—THE DILLARD NEGATIVES

FEBRUARY 25, 1979.

I have just examined the two Dillard negatives showing the so-called "Oswald" window. I am sorry to report that the negatives are both severely damaged, but in different ways.

Negative No. 8, which is the more familiar of the two, and is a wide-angle photograph, appears to be coated on its emulsion side with a coating of some type. It is possible that what this is is the emulsion itself in a badly damaged condition perhaps as a result of the radioactive testing done for the committee.

The image on the negative is also in very poor condition, and appears to show the effects of a phenomenon called reticulation. This looks like small horizontal and vertical lines running throughout the image area and extending into the marginal area surrounding the picture area itself.

I cannot determine for sure whether the crosshatching occurs in the emulsion itself or if it is on the coating (if indeed the "coating" is a foreign addition to the negative and not just damaged emulsion).

Negative No. 24 also has this problem but in addition, the negative has an area where the emulsion has been rubbed off of the base. It appears that the negative was subjected to an intensely hot liquid and rubbed to remove the radioactive coating which was applied for the analytical work done for the committee. It seems that at this time,

the wet emulsion was actually smeared by an outside force, for an area of the image has been removed from the base. It is my opinion that this damage is irreversible.

I would also like to point out the appearance of what seems to be a human figure at the extreme western window on the sixth floor of the TSBD in negative No. 8. Negatives No. 8 and No. 24 were exposed at about the same time but from two different cameras (No. 8 with a wide-angle lens and No. 24 with a telephoto lens). I would estimate that both of these photographs were exposed within 10 seconds of the last gunshots, and if the figure in the western end window is a human figure (where eyewitness Arnold Rowland saw a human figure standing) we have more proof of a larger conspiracy.

If your computer enhanced negative(s) show this area, I strongly suggest inspecting this area from it/them.

Due to the deterioration of the original negative, I cannot be sure as to what this figure is. If the computer duplicate negatives are better, it would definitely be worth examining them to study the shape.

As for the "Oswald" window, I can see no human figure in either negative.

#### ATTACHMENT 6: THE ALTGENS DOORWAY MAN ISSUE

The main items used by me in determining the true identity of the man in the TSBD doorway in the fifth Altgens photograph were:

The John Martin film original.—This camera original, when viewed under the correct lighting conditions, shows that the degree of facial growth on Billy Lovelady was not as great as it originally appeared in the DCA release prints;

The Robert Hughes film original.—This color film shows the color of the shirt that Mr. Lovelady is wearing. The colors seem to be consistent with the shirt worn by Mr. Lovelady in the Martin film (above);

The Mark Bell film original.—This film was taken at a closer range than the Hughes film and was taken at the same time. It clearly shows the color and pattern of the shirt worn by the doorway man. It is consistent with the shirt worn by Mr. Lovelady; and

The James Altgens negative original.—The photograph that started it all is the best evidence as to the identity of the man pictured in the doorway of the TSBD. The pattern of light and dark plaid is heightened through the technique of vario-density cynexing directly onto Kodak 5302 fine grain release positive to give a full range of contrast and density results for careful high magnification study. Using this process, which I developed several years ago for this purpose, it can be seen, even by a layman, that the pattern is indeed that of Mr. Lovelady. This technique yields images perhaps two to four times clearer than conventional photographic methods.

ROBERT J. GRODEN,  
*Photographic consultant, HSCA.*



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(242) Clyde Snow and Joan Williams, "Variation in Premortem Statural Measurements Compared to Statural Estimates of Skeletal Remains," Journal of Forensic Sciences, October 1971, vol. 16, No. 4, p. 456.

(243) Testimony of James W. Altgens, July 22, 1964, 7 Warren Commission Hearings, 517; the photographic evidence panel correlated the Altgens photograph in time to Zapruder frame 255.

(244) Warren report, p. 644.

(245) Testimony of Billy Nolan Lovelady, Apr. 7, 1964, 6 Warren Commission Hearings, 338-39.

(246) Testimony of William H. Shelley, Apr. 7, 1964, 6 Warren Commission Hearings, 328; statement of Buell W. Frazier, Mar. 18, 1964 (CE 1381), 22 Warren Commission Hearings, 647; statement of Sarah D. Stanton, Mar. 18, 1968 (CE 1381), 22 Warren Commission Hearings, 675.

(247) See ref. 2, Lane, pp. 354-356; Shaw, pp. 39-42.

(248) See ref. 2, Meagher, p. 362.

(249) CE 1408, May 24, 1964, New York Herald-Tribune story, 22 Warren Commission Hearings, 793-94; see ref. 2, Model and Groden, pp. 147-49; Meagher, p. 363; and Thompson, pp. 225-27.

(250) Ibid.

(251) Letter from FBI Director J. Edgar Hoover to J. Lee Rankin, Mar. 9, 1964, Commission document 457.

(252) See ref. 2, Thompson, p. 227; outside contact report with Billy Nolan Lovelady, July 5, 1978 House Select Committee on Assassinations (JFK Document 009727).

(253) Memorandum from Robert Groden to the House Select Committee on Assassinations, July 21, 1978 (JFK Document 010209).

(254) See ref. 210, RIT report, p. 36.







Western New England College



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# INVESTIGATION OF THE ASSASSINATION OF PRESIDENT JOHN F. KENNEDY

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## APPENDIX TO HEARINGS

BEFORE THE

### SELECT COMMITTEE ON ASSASSINATIONS

OF THE

### U.S. HOUSE OF REPRESENTATIVES

NINETY-FIFTH CONGRESS

SECOND SESSION

---

VOLUME VII

MEDICAL AND FIREARMS EVIDENCE

---

MARCH 1979

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Printed for the use of the Select Committee on Assassinations



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Investigation of the Assassination  
of President John F. Kennedy,  
Part 7

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(III)





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MEDICAL EVIDENCE AND RELATED ISSUES  
PERTAINING TO THE ASSASSINATION OF  
PRESIDENT JOHN F. KENNEDY

---

Select Committee on Assassinations  
U.S. House of Representatives  
Ninety-fifth Congress  
Second Session

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March 1979

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## PREFACE\*

This section of the appendix to the hearings deals with the medical evidence relating to the assassination of President John F. Kennedy and the wounding of Governor John B. Connally of Texas. Section 1, introduction, presents a historical overview of the material, lists the issues addressed, outlines the investigative procedure of the committee, and briefly summarizes the content of the remaining four sections. These sections are: Performance of the autopsy (sec. 2); chain of custody of the materials acquired during the autopsy (sec. 3); authenticity of the autopsy photographs and X-rays (sec. 4); and the report of the forensic pathology panel (sec. 5).

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\* Materials submitted for this report by the committee's forensic pathology panel were compiled by HSCA staff members Donald A. Purdy, Jr. and T. Mark Flanagan.





## SECTION I. INTRODUCTION

(1)\* John F. Kennedy was the fourth American President to be assassinated, the first in 60 years. In each case, pathologists performed an autopsy to determine the cause of death and the nature of the injuries. It is quite remarkable that despite major advances in medical technology, the autopsy of President Kennedy created more controversy than that of any of the others.

(2) In the case of the autopsy of Abraham Lincoln in 1865, physicians conducted the examination in the White House within several hours following the President's death. Those in attendance included several of the physicians who regularly treated the President. While a major dispute arose during the autopsy concerning the path of the missile through the President's head, the matter was finally settled. The pathologists forwarded an official autopsy report in a letter to the Surgeon General of the United States. The X-ray technology that could have assisted in resolving the dispute had not yet been invented.

(3) The autopsy of James Garfield in 1881 did not trigger any controversies. The autopsy surgeons, who likewise included several of the President's regular physicians, preserved certain physical specimens for later examination and issued a report, which included sketches to document the location of the wounds.

(4) The autopsy of William McKinley in 1901 was controversial. The problems began when his wife successfully halted the autopsy after 4 hours, even though the surgeons had not located the missile. The autopsy report indicated that this intervention prevented the physicians from removing all the portions of tissue necessary for proper examination. Interestingly, although Thomas Edison made available his newly invented X-ray machine the physicians refused to use it. After the autopsy a dispute arose over the path of the missile and gained so much momentum that the pathologists had to issue a statement in an effort to quell rumors.

(5) The autopsy of President Kennedy has been the most controversial. For example, it is the only one in which the physicians who normally provided medical treatment to the President were not in attendance.

(6) The handling of the emergency medical treatment and the autopsy of President Kennedy by the various physicians, the Warren Commission, and the President's family not only has generated more controversy than any other Presidential autopsy, it has also raised many questions regarding the assassination overall, more so than any other factor.

---

\* Arabic numerals in parentheses at the beginning of paragraphs indicate the paragraph number for purposes of citation and referencing; italic numerals in parentheses in the middle or at the end of sentences indicate references which can be found at the end of each report or section.

(7) Confusion and speculation over the nature of the injuries to the President surfaced immediately in the wake of his emergency treatment on November 22, 1963, at Parkland Memorial Hospital, Dallas, Tex., and his autopsy later that evening at Bethesda Naval Hospital, Bethesda, Md. The following summaries of news accounts from the New York Times in the first days after the assassination demonstrate the confusion:

November 24, 1963—the President suffered an entrance wound in the Adam's apple and a massive head wound in the head.

December 17, 1963—the FBI concluded that one bullet had struck the President in the right temple and another had hit where the right shoulder joins the neck.

December 19, 1963—the pathologists had determined that a bullet had lodged in the back, a second had struck the right rear of the head.

(8) While the newspapers continued to chase rumors, the FBI compiled a report on the assassination, which Director of the FBI, J. Edgar Hoover submitted to the Warren Commission on December 19, 1963. A supplemental report was also sent to the Commission on January 13, 1964. This report reflected the observations made by the FBI agents who attended the autopsy.

(9) By early February 1964, the single bullet theory—the theory that one bullet traversed the upper back and neck of President Kennedy and then caused all the wounds to Governor Connally—began to emerge. During the next several months of 1964, the Warren Commission questioned most of the doctors associated with the medical evidence pertaining to President Kennedy and Governor Connally. There was no evidence that any members of the Warren Commission or its staff ever viewed any of the autopsy photographs or X-rays of President Kennedy. Nevertheless, in the fall of 1964, the Warren Commission concluded in its final report that President Kennedy had been struck by two missiles, as reflected in the autopsy report, and that the missile that exited the President's neck also caused all of Governor Connally's wounds. The Warren Commission also concluded that the missile that struck both the President and the Governor was the one discovered at Parkland Hospital.

(10) The next significant event regarding the autopsy occurred on April 22, 1965, when Robert F. Kennedy, then the Attorney General, authorized Dr. George Burkley, the White House physician, to transfer materials derived from the autopsy—autopsy photographs, autopsy X-rays, microscopic tissue slides and physical specimens such as the brain, which had been stored at the White House since the autopsy—to Mrs. Evelyn Lincoln, the former personal secretary to President Kennedy, who then had an office in the National Archives. On April 26, Robert I. Bouck, the head of the Protective Research Division of the U.S. Secret Service, where the autopsy materials were stored in the White House, and Dr. Burkley prepared an inventory list and transferred the materials. The photographs and X-rays from the autopsy, as well as the microscopic slides and other gross material, allegedly including the brain, were transferred at that time.



(11) Although Mrs. Lincoln had an office in the Archives, she was not an employee. Consequently, when the materials were transferred, they were not technically given to the National Archives.

(12) Over the next few years various critics continued to question the autopsy conclusions. In 1966, Edward Jay Epstein, in his book *inquest*, related that, although the FBI had had access to the autopsy report of Dr. Humes, in its report of December 9, 1963, it had stated that the missile entering the President's upper back did not exist. Epstein concluded that this discrepancy cast serious doubts on the accuracy of the entire investigation of the Commission.

(13) In 1966, Mark Lane, an attorney from New York, also published a book, entitled "Rush to Judgement," which was critical of the Warren Commission. Lane questioned the theory that a lone assassin shot the President from the rear. He cited the initial comments of several Parkland Hospital doctors who characterized the throat wound as one of entrance. He theorized that if the President had been shot from the front, then more than one assassin had to have been involved. Lane also criticized vehemently the single-bullet theory, contending that the Warren Commission devised it in order to explain how one assassin could have inflicted all the wounds to the President and the Governor by firing three shots in the requisite time interval. Lane argued that the single-bullet theory was not possible and that consequently only one alternative existed: more than one assassin shot at the President.

(14) In November 1966, the autopsy pathologists reviewed the autopsy X-rays and photographs now in the custody of the National Archives. They did so at the request of the Department of Justice, which wanted to determine their consistency with the autopsy report.

(15) The pathologists had never seen the photographs previously. They agreed that the photographs and X-rays corroborated their autopsy report.

(16) These photographs and X-rays had become the property of the U.S. Government as a result of a deed of gift from the Kennedy family to the National Archives on October 31, 1966. All materials listed in the 1965 transfer from the White House to Evelyn Lincoln were to be included in this transaction, but the microscopic slides and the gross material, including the brain, were found to be missing. The disposition of these "missing" materials was not documented at this or any other time.

(17) As more persons published books critical of the Warren Commission, more issues emerged concerning the autopsy. In 1967, Josiah Thompson published "Six Seconds in Dallas," in which he proposed the theory that President Kennedy was struck in the head simultaneously by two shots: One from the rear and one from the front. Thompson based this on the rear head motion visible in the Zapruder film, the reports from the Parkland and Bethesda surgeons, and eyewitness accounts. This theory necessarily involves two assassins. Sylvia Meagher also published a voluminous work in 1967, entitled "Accessories After the Fact"; she further criticized the Warren Commission findings and advanced alternative theories.

(18) By 1968, as a result of criticisms and allegations surrounding the Warren Commission's conclusions, then-Acting Attorney General

Ramsey Clark convened a panel of medical experts, commonly referred to as the Clark panel, for the first independent review of the autopsy photographs and X-rays. Although the panel confirmed the autopsy pathologists' findings regarding the number of shots that struck the President and their general direction through the body, it stated that the entrance wound on the President's head was actually 10 centimeters (about 4 inches higher) than indicated in the autopsy report. This conclusion generated even more confusion and doubt concerning the validity of the autopsy.

(19) In 1975, in the midst of mounting criticism, the Rockefeller Commission convened a group of medical and firearms experts to review the evidence. They concurred with the opinions of the Clark panel. Both the Clark and Rockefeller panels, however, conclusions were presented without supporting material. Doubts and rumors persisted.

(20) In 1976, the House passed a resolution establishing the committee and empowered it to conduct a full and complete investigation into the circumstances surrounding the death of President Kennedy. The committee determined that it should examine, among other things, the major issues that had arisen over the years in connection with the autopsy of the President and related medical evidence. These issues included:

1. How many missiles struck President Kennedy and Governor Connally, specifically, whether President Kennedy could have been struck in the head from behind and from the front simultaneously and whether the backward motion of the President's head, visible in the Zapruder film, is consistent with the conclusion that the President was struck only from behind;
2. The feasibility that one missile entered President Kennedy's back, exited his neck, and then caused all of Governor Connally's wounds, with little damage to the missile;
3. The origin and trajectories of the missiles;
4. The number of wounds President Kennedy and Governor Connally received, their respective locations, whether they were entrance or exit wounds, and the reasons for those characterizations;
5. Whether the nature of the wounds to President Kennedy and Governor Connally was consistent with the damage that would be caused by 6.5 millimeter caliber Mannlicher-Carcano ammunition and in particular a single bullet traversing two bodies;
6. The accuracy of the opinions of the Parkland Hospital doctors concerning the location of President Kennedy's wounds and reasons for those opinions;
7. The discrepancies in various reports about wound locations, especially those between the official autopsy report and the findings of the Clark panel and the Rockefeller Commission panel concerning the location of the rear head wound;
8. The thoroughness, competence, and accuracy of the autopsy with respect to both the medical aspects and those bearing on possible future litigation in court;
9. The location and fate of the microscopic tissue slides and gross materials, including the brain, which the pathologists retained for future study and which are now unaccounted for;



10. The possibility that at some time the autopsy photographs and X-rays were doctored or that they were false or incomplete;
11. Whether the autopsy was performed within the proper jurisdiction;
12. What chain of custody was followed for the various items of evidence; and
13. Whether other procedures should have been followed and what procedures should be followed in the event of other assassinations.

(21) In addressing these issues, the committee decided to analyze some issues itself and to retain experts to examine others. Specifically, the committee prepared a report on issues relating to the performance of the autopsy and thoroughly traced the chain of custody of the "missing" autopsy materials.

(22) The committee consulted experts in the fields of forensic odontology, radiology, chemical engineering, and photography in examining the authenticity of the autopsy photographs and X-rays.

(23) Finally, the committee convened a panel of forensic pathologists to address the medical issues relating to the death of President Kennedy and the wounding of Governor Connally and to recommend procedures to be followed in the event of future assassinations.

(24) The panel of forensic pathologists consisted of two subpanels: One of members who had not previously reviewed the autopsy photographs, X-rays, and related material, the other of those who had.

Panel members who had not previously reviewed the evidence were:  
John I. Coe, M.D., chief medical examiner of Hennepin County, Minn.

Joseph H. Davis, M.D., chief medical examiner of Dade County, Miami, Fla.

George S. Loquvam, M.D., director of the Institute of Forensic Sciences, Oakland, Calif.

Charles S. Petty, M.D., chief medical examiner, Dallas County, Dallas, Tex.

Earl Rose, M.D., LL.B., professor of pathology, University of Iowa, Iowa City, Iowa.

Panel members who had previously reviewed the evidence were:

Werner V. Spitz, M.D., medical examiner of Detroit, Mich.

Cyril H. Wecht, M.D., J.D., coroner of Allegheny County, Pa.

James T. Weston, M.D., chief medical investigator, University of New Mexico School of Medicine, Albuquerque, N. Mex.

The chairman of the panel was Michael M. Baden, M.D., chief medical examiner of New York City.

(25) The committee asked that the two subpanels present their views in a single report, with the stipulation that any member could submit a dissenting opinion that would be included with the report.

(26) The remainder of this volume contains the evidence developed by the committee and the findings and conclusions of the forensic pathology panel. It is divided into three sections: An analysis of the performance of the autopsy of President John F. Kennedy (sec. 2); a presentation of the efforts of the committee to trace the chain of custody of the materials acquired during the autopsy (sec. 3); and, finally, the report of the panel on forensic pathology (sec. 4). Each section includes a statement of the issues addressed, the evidence considered, and the conclusions reached.



## SECTION II.—PERFORMANCE OF AUTOPSY

### PART I. INTRODUCTION

(27) Throughout the last 15 years, many critics have questioned the competency and validity of the autopsy of President Kennedy. The efforts of the U.S. Department of the Navy and other Government sources to insure privacy with respect to the autopsy procedures and other events that took place at Bethesda Naval Hospital have contributed in part to much of the uncertainty and skepticism. Included in these efforts was an order of silence issued to the participants in the autopsy.(1)

(28) Because of this skepticism and in accordance with its mandate to conduct a full and complete investigation into the circumstances surrounding the death of President Kennedy, the committee decided to investigate the performance of the autopsy. The focus was to be on the following issues:

1. The possibility that someone ordered or otherwise strongly suggested that the autopsy doctors perform a limited or incomplete autopsy;
2. The question of the competency and validity of the autopsy; and
3. The documentation of the events that occurred, how they occurred, and when they occurred.

(29) The committee conducted a review of all documentary evidence and contacted almost all persons still alive who had attended the autopsy. The Department of the Navy agreed to rescind the orders of silence issued to the autopsy personnel.

(30) The following material relates the issues and corresponding facts chronologically (part II) and then presents the conclusions of the committee.

(31) The evidence indicates that while the pathologists were given authority to perform a complete autopsy, the autopsy was not complete according to established medicolegal standards.

### PART II. FACTS AND ISSUES

#### *Background*

(32) At 1:30 p.m., eastern standard time (e.s.t.), on November 22, 1963, President Kennedy and Governor Connally were shot while riding in a Presidential motorcade through the streets of Dallas, Tex. The driver of the Presidential limousine, Secret Service Agent William Grier, immediately drove the limousine at high speed to Parkland Memorial Hospital, Dallas, Tex., arriving at approximately 1:35 p.m., e.s.t.(2) Having been alerted to the emergency by radio, Parkland Hospital personnel quickly escorted the wounded President and Governor into the emergency treatment facilities.

(33) Drs. Malcolm Perry and Charles J. Carrico were two of the first doctors to attend the President. In addition to a massive head wound,

both observed a small, circular wound situated in the region of the neck below the adam's apple, which they subsequently characterized as an entry wound. (3) To combat the President's failure to breathe, Dr. Perry decided to perform a tracheotomy. (4) In doing so, he cut through the small, circular neck wound, making it difficult to identify the missile wound. (5)

(34) With respect to the head wound, Dr. Robert McClelland, another of the doctors who attended the President, said in his testimony before the Warren Commission, that the right posterior section of the skull had been blasted. (6) Dr. Kemp Clark, who also assisted with the President, similarly described the wound as being in the back of the President's head—in the right posterior part. (7)

(35) The Parkland doctors soon realized their efforts to save President Kennedy were fruitless. Dr. Clark pronounced him dead at 2 p.m., e.s.t. (8)

(36) The total time that the doctors had observed or treated the President was approximately 20 minutes. They had been concerned only with administering emergency treatment. Their primary concern was to restore the breathing and stop the bleeding. None examined the President's back—and so did not discover any wound there. Further, none observed any wound to the head other than the one massive wound. Nor was their job to measure precisely the location of the wounds or to examine the body for all possible wounds. When the President died, the Parkland doctors' functions also ended. (9)

(37) Drs. Robert Shaw, Charles Gregory, and George Shires treated the wounds of Governor Connally. (10) In their medical reports, they described wounds to his chest, wrist, and thigh.

(38) Soon after Dr. Kemp Clark of Parkland Hospital, Dallas, Tex., pronounced the President dead, the Secret Service and other personnel proceeded to transport the body from Texas to Washington, D.C. While in flight, Mrs. Kennedy chose Bethesda Naval Hospital in Bethesda, Md., as the site for the autopsy, since the President had served in the Navy. (11)

(39) The Secret Service and the Navy Department made arrangements for the performance of the autopsy. (12) The surgeon general of the Navy and the commanding officer of the Naval Medical School advised Comdr. James J. Humes, the director of laboratories of the National Medical School, (13) Naval Medical Center, Bethesda, Md., that the Secret Service was transporting the body of the President to Bethesda and that he was to ascertain the cause of death. (14)

(40) The FBI authorities contacted their Baltimore field office and advised that arrangements should be made for Bureau agents to proceed to Andrews Air Force Base, Camp Springs, Md., to meet Air Force One and to handle any matters that would fall within FBI jurisdiction. (15) Consequently, Special Agents Francis X. O'Neill, Jr., and James W. Sibert proceeded to Andrews Air Force Base. Their specific instructions were to accompany the body at all times, ride in the motorcade to Bethesda Naval Hospital, witness the autopsy, preserve the chain of custody of any evidentiary material, and transport any bullets that might be recovered to the FBI Laboratory. (16)

(41) On arrival at Andrews Air Force Base, a motorcade transported the body of the President to the Bethesda Naval Hospital, (17) with Special Agents Sibert and O'Neill traveling in the third car. (18) At

Bethesda, the ambulance first stopped at the main entrance; Mrs. Jacqueline Kennedy and Attorney General Robert F. Kennedy got out (19) and joined other members of the Kennedy family on the 17th floor of the hospital to await the conclusion of the autopsy. (20) The ambulance then proceeded to the rear of the building, arriving at approximately 7:35 p.m. (21). Personnel carried the body into the hospital. (22)

(42) Dr. Humes chose J. Thornton Boswell, M.D., chief of pathology at Bethesda, (23) and Pierre A. Finck, M.D., chief of the military environmental pathology division and chief of the wound ballistics pathology branch at the Armed Forces Institute of Pathology at Walter Reed Medical Center, (24) to assist him in performing the autopsy. During the autopsy, Special Agents Sibert and O'Neill recorded the names of what they believed were all the persons in attendance at any time. (25) In a report they submitted subsequent to the autopsy, they included: (26)

1. Adm. Calvin B. Galloway, commanding officer of the U.N. National Naval Medical Center;
2. Adm. George C. Burkley, White House physician to the President;
3. Comdr. James J. Humes, director of the laboratories of the National Medical School, Naval Medical Center, Bethesda, Md.;
4. Capt. James H. Stover, Jr., commanding officer of the Naval Medical School;
5. John Thomas Stringer, Jr., medical photographer;
6. James H. Ebersole, assistant chief radiologist at the Bethesda Naval Medical Center;
7. Floyd Albert Riebe, medical photographer;
8. J. Thornton Boswell, chief of pathology at Bethesda;
9. Jan Gail Rudnicki, laboratory technologist, assisting Dr. Boswell;
10. Pierre A. Finck, M.D., chief of the military environmental pathology division and chief of the wound ballistics pathology branch at Walter Reed Medical Center; (27)
11. Paul K. O'Conner, laboratory technologist;
12. Jerrol F. Custer, X-ray technician;
13. James Curtis Jenkins, laboratory technologist;
14. Edward F. Reed, X-ray technician;
15. James E. Metzler, hospital corpsman third-class;
16. Capt. David Osborne, chief of surgery;
17. Brig. Gen. Godfrey McHugh, Air Force aide to the President;
18. Lt. Comdr. Gregory H. Cross, resident in surgery;
19. Gen. Philip C. Wehle, commanding officer of the U.S. Military District, Washington, D.C.;
20. Chester H. Boyers, chief petty officer in charge of the pathology division;
21. Dr. George Bakeman, U.S. Navy (the committee could not locate this person);
22. Secret Service Agent Roy Kellerman;
23. Secret Service Agent William Greer; and
24. Secret Service Agent John J. O'Leary. (28)

(43) Through its own investigation, the committee determined that the following persons also attended the autopsy:



1. Richard A. Lipsey, personal aide to General Wehle;(29) and
2. Samuel Bird,(30) in 1963, a lieutenant stationed at the ceremonial duties office, Fort Myers, Va., 3d Infantry Division.

(44) Additionally, Sibert and O'Neill reported that, following the autopsy, four persons from Gawler's Funeral Home in Washington, D.C., entered the autopsy room to prepare the President's body for burial. They were:

1. John Van Haeson;
2. Edwin Stroble;
3. Thomas Robinson; and
4. Mr. Hagen.(31)

(45) These persons, together with Sibert and O'Neill, were the only ones present at any time in the autopsy room with the body of the President.

(46) In their report, Sibert and O'Neill noted that the body of the President was removed from the casket in which it arrived and placed on the autopsy table.(32) They said that a sheet covered the entire body; an additional wrapping, saturated in blood, surrounded the head.(33)

(47) Dr. Humes had testified previously to the Warren Commission that the body was received in a casket, was wrapped in a sheet, and was unclothed.(34) James Jenkins, a student laboratory technician, whose normal duties included admitting a body to the morgue and conducting an initial examination, likewise stated that the body of the President was unclothed and that it may have been wrapped in a sheet.(35)

(48) A major issue in the initial stages of the autopsy was whether Dr. Humes had authority to perform a full or partial autopsy.\*

(49) The belief that Dr. Humes had authority for only a partial autopsy derived from several factors. Special Agent O'Neill told the committee that he recalled that Mrs. Kennedy had given permission for a partial autopsy and that Dr. Burkley, the President's physician, reiterated her remarks in the autopsy room.(36) He believed there was no question that Dr. Burkley was conveying the wishes of the Kennedy family regarding a full-versus-partial autopsy.(37) Special Agent Sibert told the committee that he, too, had the impression the Kennedy family was somehow transmitting step-by-step clearances to the pathologists.(38)

(50) John Stringer, the medical photographer, likewise recalled some discussion at the beginning of the autopsy concerning the scope of the autopsy. He said he believed Dr. Burkley played a central role in the discussions and seemed to be acting on behalf of the Kennedy family.(39) He specifically recalled Dr. Burkley indicating to the doctors that they should not conduct a full autopsy, saying, " \* \* \* (you) shouldn't do a complete one if (you) don't have to."(40)

(51) Adm. David Osborne (then captain) stated that at the beginning of the autopsy there was tremendous pressure to perform a "quick post" and to leave the hospital.(41)

(52) The evidence supports the above recollections. They reflect the general nature of the initial stages of the autopsy: somewhat confused at the beginning with discussions concerning the extent and nature of

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\*The scope of Dr. Humes' authority and the scope of the performance are two distinct issues. Dr. Humes may have had authority to perform a full or complete autopsy, but may have performed a partial one.

the autopsy to be performed. The evidence also indicates, however, that these observations do not reflect the total picture and that Dr. Humes ultimately received permission to perform a complete autopsy. The following memorandum is a primary source :

DATE : NOVEMBER 26, 1963.

To : SAC, Baltimore.

From : SA's James W. Sibert and Francis X. O'Neill, Jr.

Subject : Assassination of President John F. Kennedy.

Following arrival at the Naval Medical Center and preparation of the President's body for inspection and autopsy, to be performed by Dr. Humes, chief pathologist and commander, U.S. Navy, Admiral Burkley, the President's personal physician advised that Mrs. Kennedy had granted permission for a limited autopsy and he questioned any feasibility for a complete autopsy to obtain the bullet which had entered the President's back.

At this point, it will be noted Dr. Humes, as the physician conducting the autopsy, stated it was his opinion that the bullet was still in the President's body and could only be extracted through a complete autopsy, which he proposed to do.

Special Agent Roy Kellerman, Secret Service, in conference with Special Agents Sibert and O'Neill, from an investigative and protective standpoint, advised Admiral Burkley that it was felt the bullet should be located.

At this point, Adm. C. B. Galloway, Commanding Officer of the National Naval Medical Center, Bethesda, Md., told Commander Humes to perform a complete autopsy.

(53) Special Agent O'Neill corroborated the information in this memorandum in an affidavit and in his interview with the committee.(42) In addition, Admiral Osborne (the Captain) stated in a committee interview that Dr. Humes was successful in resisting pressure to perform an incomplete autopsy and that no one issued any orders limiting it.(43) Admiral Galloway also stated that no one transmitted any orders to limit the autopsy in any manner and that this memorandum was consistent with his recollections.(44)

(54) For these reasons, it may be concluded that Dr. Humes possessed authority to perform a complete autopsy.

(55) During the initial stages of the autopsy, when the discussion over a full-versus-partial autopsy occurred, the pathologists conducted an examination of the exterior of the body and took photographs and X-rays before making any incisions.(45) This is when the pathologists observed that a tracheostomy had been performed on the President.(46)

(56) Stringer(47) and Riebe(48) took the autopsy photographs under the direction of Dr. Humes. Stringer told the committee that his equipment included a 4- by 5-inch graphic view camera that had a standard lens and used film holders which contained one segment of film on each side.(49) He also stated that as he photographed the body, he would give the film to a Secret Service agent standing adjacent to him who later signed a receipt to Captain Stover to obtain formal custody of the film.(50) Such a receipt—from Capt. J. H. Stover, Jr., commanding officer of the U.S. Naval Medical School to Roy H. Kellerman, assistant special agent in charge, U.S. Secret Service—does exist.(51)

(57) Stringer also stated that a Federal agent took a camera from Riebe and exposed the film.(52) This apparently occurred because the agent felt Stringer was the only person authorized to photograph the body and that Riebe was only to assist Stringer and not take photographs on his own initiative.



(58) Special Agents Sibert and O'Neill confirmed that the pathologists had X-rays taken before and after making incisions.(53) Dr. Ebersole, the acting chief of the radiology department that evening, stated in a deposition to the committee that prior to commencing the autopsy he took several X-rays of the skull, chest and trunk of the body.(54) He stated that he used portable X-ray equipment (55) and did not take X-rays of the hands and feet.(56) Dr. Ebersole further told the committee that he hand carried these films in their cassettes to the fourth floor of the hospital, where a darkroom technician developed them and then returned them to him. Ebersole then hand carried them back to the autopsy room.(57)

(59) After completion of the autopsy, before releasing the X-rays, Dr. Ebersole received a receipt from Roy H. Kellerman acknowledging possession of them.(58)

(60) Sibert and O'Neill observed that, on the basis of the preliminary X-rays, the pathologists concluded that:

\* \* \* no complete bullet of any size could be located in the brain area and likewise no bullet could be located in the back or any other area of the body as determined by total body X-rays.(59)

(61) At approximately 8:15 p.m., e.s.t, Dr. Humes made the first incision.(60) In his Warren Commission testimony, he stated that he used a routine incision:

Which is a Y-shaped incision from the shoulders over the lower portion of the breastbone and over to the opposite shoulder and reflected the skin and tissues from the interior portion of the chest.(61)

(62) Dr. Humes then began examining the missile wounds. Sibert and O'Neill noted that he located the track of a missile that appeared to enter the rear of the head and progress forward.(62) The X-rays of the skull revealed numerous minute fragments widely distributed throughout the skull, as well as two larger fragments. The pathologists commented that this indicated the missile had fragmented on passing through the skull.(63)

(63) Dr. Humes located the entrance of the missile track in the head as approximately 2.5 centimeters laterally to the right and slightly above the external occipital protuberance.(64)

(64) In the autopsy report, Dr. Humes described the exist as:

A large irregular defect of the scalp and skull on the right involving chiefly the parietal bone but extending somewhat into the temporal and occipital regions.(65)

He further stated that:

[i]n this region there is an actual absence of scalp and bone producing a defect which measures approximately 13 centimeters in greatest diameter.(66).

(65) Sibert and O'Neill observed that Dr. Humes removed two fragments from the right side of the skull; one 7 by 2 millimeters in size, the other 1 by 3 millimeters.(67) Special Agents Sibert and O'Neill signed a receipt for custody of these fragments and immedi-



ately following the autopsy transported them to Special Agent Kurt Frazier at the FBI Laboratory.(68)

(66) The receipt for the fragments has been a continuing source of controversy. It states that Bureau agents received a "missile,"(69) as opposed to two fragments. Chester H. Boyers, the corpsman who typed the receipt,(70) submitted an affidavit to the committee which stated that the receipt was for two fragments that Dr. Humes removed from the skull, despite the receipt's caption of "a missile."(71) Boyers emphasized that he gave Sibert and O'Neill only missile fragments.(72) In affidavits and committee interviews, Sibert and O'Neill also stated that Dr. Humes had retrieved two fragments and that they received these fragments and not a missile.(73)

(67) The evidence indicates that the receipt was in error and that Boyers transferred only fragments to Sibert and O'Neill.

(68) Sibert and O'Neill next observed in their report that Dr. Humes examined a wound situated below the shoulders and 2 inches to the right of the middle line of the spinal column.(74) In the autopsy report, Dr. Humes characterized this wound as an entrance wound and located it 14 centimeters from the tip of the right acromion process and 14 centimeters below the tip of the right mastoid process.(75) Dr. Humes probed this wound with his finger and concluded that the missile had only traveled a short distance because he could feel the end of the track with his finger.(76) During the autopsy, Dr. Humes stated that he and his colleagues opened the chest cavity and carefully examined the lining of the chest cavity and both lungs.(77) Admiral Galloway told the committee that the pathologists examined the brain and all of the internal organs and structures. These included the liver, heart, lungs, spleen, kidneys, and adrenal glands.(78) The autopsy protocol and supplemental report state that the doctors examined the chest cavity, lungs, heart, abdominal cavity, skeletal system, liver, spleen, kidneys, and brain, but did not list the adrenal glands.(79)

(69) In regard to the examination of the chest cavity, Dr. Humes told the Warren Commission and the committee that he specifically remembered the photographers taking Kodachrome photographs of the interior of the President's chest.(80) Stringer, one of the photographers, stated that he also thought he had taken some interior photographs of the President's chest.(81) Dr. Burkley, however, told the committee that no one took any photographs of the interior of the chest.(82) There is no evidence that such photographs exist.

(70) By this point in the autopsy, the pathologists had closely examined the body and had still not located any missile, particularly the one which entered the back. They could not explain why they could not find any bullets.(83) They then began speculating about bullets which fragment. Special Agent Sibert decided to call Special Agent Charles L. Killion at the firearms section of the FBI laboratory to inquire about fragmenting bullets.(84) On receiving this call, Killion informed Sibert that Secret Service Agent Richard Johnson had forwarded to the laboratory a bullet which reportedly had been found on a stretcher in the emergency room of Parkland Memorial Hospital in Dallas, Tex.(85) Killion described the bullet as a 6.5-millimeter rifle missile with a copper-alloy full jacket.(86)

(71) Sibert and O'Neill stated in their report that during the autopsy Dr. Humes, concluded on the basis of this information and knowing that the Parkland doctors had performed cardiac massage that they may have forced the bullet out of the President's back.(87) This theory would account for a missile track with no bullet.

(72) During the latter stages of the autopsy, authorities sent from Dallas three separate fragments of skull bone(88) found in the Presidential limousine. There is no evidence to show who sent these fragments to Bethesda. The pathologists concluded they were from the skull. Dr. Humes directed the X-raying of these fragments(89) and observed that one of the fragments contained minute metallic fragments along a line which corresponded with the large defect in the skull of the President.(90) This particular bone fragment alone exhibited bevelling of the outer table which Pierre Finck said indicated that a missile existed at that point.(91) Both Dr. Humes and Dr. Burkley informed the committee that these fragments were placed back in the skull of the President.(92)

(73) By the termination of the autopsy at approximately 11 p.m., (93) the pathologist had formulated the following general conclusions:

1. One missile entered in the rear of the skull of the President and exited in the front of the skull; and
2. One missile entered the back of the President and was apparently dislodged during cardiac massage at Parkland Hospital.(94)

(74) Admiral Galloway corroborated these statements before the committee, saying that an assassin or assassins shot the President from behind with two shots.(95)

(75) After completing the autopsy, Dr. Humes remained to assist the morticians in preparing the President's body.(96) Secret Service Agent Kellerman said that after the morticians had prepared the body, the Secret Service agents and the Kennedy family left the hospital at 3:56 a.m. and went to the White House.(97)

*Additional issues arising from the performance of the autopsy*

(76) Although Dr. Humes had authority to perform a complete autopsy, the committee still had to resolve the issue of the actual scope of the autopsy. Specifically, Dr. Humes may have decided on his own initiative to limit the autopsy in certain respects or, despite the initial grant of authority, some factors may possibly have surfaced during the course of the autopsy which may have impinged on the independent decisionmaking of Dr. Humes.

(77) Dr. Pierre Finck, one of the pathologists, asserted in a sworn statement to the committee that he believed the autopsy was incomplete:

Because of the restrictions I suggested or said I felt it was not complete, but Dr. Humes then said that the autopsy had accomplished the purposes as stated—the number of wounds, the direction of the projectiles and the cause of death—so I was actually satisfied.(98)

Dr. Finck later stated that restrictions from the family (were)the



reason for limiting our actions.(99) Specifically, Dr. Finck contends that someone ordered them (the pathologists) not to dissect the missile track that began in the upper back and progressed forward into the neck region. When questioned about the source of this order, Dr. Finck stated:

I cannot say that it was this army general, I can't recall that precisely. I remember the prosecutors and Admiral Galloway. As far as saying now so and so told me that or didn't tell me that, it is extremely difficult. There was an army general in that room and I cannot readily pinpoint the origin of those instructions to comply with those family wishes.(100)

(78) The committee determined that it was Dr. Humes and not any army general or other person who made the decision not to dissect the back entry wound. The following exchange between one of the medical consultants for the committee and Dr. Humes supports this conclusion:

Dr. BADEN. Now, for example, not exploring the wound from the back to the neck, that was not done. I mean, cutting it open completely. That wasn't done specifically; was that because somebody said, "Don't do it"?

Dr. HUMES. Now wait a minute, that wound was excised.

Dr. BADEN. The back wound?

Dr. HUMES. Yes, sir. The back of the neck, and there are microscopic slides of that wound.

Dr. BADEN. I see. The skin was taken out. And then was it—

Dr. HUMES. It was probed.

Dr. BADEN. Was it opened up?

Dr. HUMES. It was not laid open.

Dr. BADEN. Now that was your decision as opposed to somebody else's decision?

Dr. HUMES. Yes. It was mine.(101)

(79) The committee also investigated the possibility that the Kennedy family may have unduly influenced the pathologists once the autopsy began, possibly by transmitting messages by telephone into the autopsy room.\* Brig. Gen. Godfrey McHugh, then an Air Force military aide to the President, informed the committee that Attorney General Robert F. Kennedy and Kenneth O'Donnell, a presidential aide, frequently telephoned him during the autopsy from the 17th floor suite.(102) McHugh said that on all occasions, Kennedy and O'Donnell asked only to speak with him.(103) They inquired about the results, why the autopsy was consuming so much time, and the need for speed and efficiency, while still performing the required examinations.(104) McHugh said he forwarded this information to the pathologists, never stating or implying that the doctors should limit the autopsy in any manner, but merely reminding them to work as efficiently and quickly as possible.(105)

(80) While General McHugh or others may not have stated or implied that the doctors should limit the autopsy, their remarks no doubt caused consternation, although they may not have substantively affected the autopsy. The following passage explains this view:

\* There was a telephone in the autopsy room.



(81) Dr. HUMES. There were no questions but we were being urged to expedite this examination as quickly as possible, that members of the President's family were in the building, that they refused to leave the premises until the President's body was ready to be moved; and similar remarks of the vein which we made every effort to put aside and approach the investigation in as scientific a manner as we could. But did it harass us and cause difficulty—of course it did, how could it not!

Dr. BOSWELL. I don't think it interfered with the manner in which we did the autopsy.

Dr. HUMES. I don't either. (106)

(82) Dr. Boswell further stated that there were no constraints. (107) Dr. Ebersole, the radiologist, likewise informed the committee that "[t]o the best of my knowledge there were absolutely no restrictions and it was Dr. Humes' decision as to the extent of the autopsy." (108) Stringer, one of the medical photographers, also could not recall anyone issuing any orders. (109) He stated specifically that while McHugh manifested a great deal of emotion, he did not issue any orders. (110)

(83) This evidence indicates that:

1. Commander Humes had full authority to perform a complete autopsy, and indeed, that Admiral Galloway told him to do so;
2. Commander Humes, not anyone else, made any decision that resulted in a deviation from a complete forensic autopsy; and
3. The remarks of others to expedite the autopsy were probably the reason for the decision to perform a less than complete autopsy.

(84) In a committee telephone interview with Admiral Osborne, another issue arose. He stated that he thought he recalled seeing an intact slug roll out from the clothing of President Kennedy and onto the autopsy table when personnel opened the casket and removed the clothing from the body of the President. (111)

(85) The committee reviewed thoroughly all documents and recontacted those persons who moved the body of the President from the casket onto the autopsy table and then prepared the body for examination. Paul K. O'Connor, who along with James Jenkins, had the duty of preparing the body for the autopsy, said the body had arrived at about 8 p.m. and was wrapped in a body bag, the head in a sheet. (112) O'Connor said he assisted in unwrapping the sheet (113) and could not recall any foreign object, specifically a missile, being discovered during the autopsy or while unwrapping the sheets. (114)

(86) Jenkins likewise said he could not recall any foreign objects being discovered or discussed and specifically could not recall any missile or fragments of a missile falling out onto the autopsy table or floor. (115)

(87) Throughout the committee's investigation, no one had ever mentioned the discovery of a missile in Bethesda Naval Hospital. The only bullet recovered was the one discovered at Parkland Memorial Hospital.

(88) Following this investigation, the committee recontacted Admiral Osborne and informed him that the body of the President had not arrived in any clothes, but was wrapped in sheets, (116) and that no one else recalled anything about the discovery of a missile. (117)

Admiral Osborne then said that he could not be sure he actually did see a missile and that it was possible the FBI and Secret Service only spoke about the discovery of a missile. He did say he was positive only one bullet was ever recovered, whether it was discovered at Bethesda Hospital or Parkland Hospital. (118)

### *Post-autopsy events*

(89) On Saturday morning, November 23, Dr. Humes informed the committee that he fulfilled a religious commitment and then met with the other two autopsy pathologists in the late morning (119) to discuss the preparation of the autopsy report. Dr. Humes said he then called Parkland Memorial Hospital in Dallas to speak with the doctors who had administered emergency treatment to President Kennedy. (120) Dr. Perry, one of the first physicians to see and treat the President, told the committee that Dr. Humes called him twice, separated by about a 30-minute interval. (121) During the first call, Dr. Perry told Dr. Humes that due to the President's failure to breathe, he had determined a tracheostomy was necessary, then or never, and therefore made a transverse incision straight through the bullet wound in the anterior aspect of the neck at approximately the second or third tracheal ring. (122) The second call involved a discussion of the chest incisions made on the President at Parkland. (123)

(90) As a result of these telephone calls, Dr. Humes concluded that the missile which had entered the upper back had traversed the body and exited in the anterior portion of the neck, (124) although he had not observed the remains of any such hole during his examination of the body.

(91) Following the telephone calls with Dr. Perry, Dr. Humes went home and rested until late that afternoon and then proceeded to write the autopsy protocol (autopsy report). (125) He told the committee that after writing the report he destroyed the original notes because they were stained with the blood of the President and he felt it would be "inappropriate to retain [them] to turn in to anyone in that condition." (126)

(92) In preparing the autopsy protocol, Dr. Humes did not have access to the autopsy photographs or X-rays. (127) (This was also the case with respect to his Warren Commission testimony.)

(93) After completion of the autopsy protocol (128), Dr. Humes hand-carried the document to the Office of the White House Physician at approximately 6 p.m. that evening. (129) The general conclusions were that:

1. One missile entered in the rear of the skull of the President and exited in the front of the skull; and
2. One missile entered the back of the President and exited in the front of the neck. (130)

(94) The pathologists completed a supplementary report approximately 11½ weeks later and delivered it to the White House Physician on December 6, 1963. (131)

### PART III. CONCLUSIONS

(95) The two major issues connected with the autopsy are its scope—full versus partial—and the competency with which the prosecutors



performed it. Despite allegations that the Kennedy family or other authorities ordered a partial or limited autopsy, evidence shows that the pathologists were given authority to perform a complete autopsy. The autopsy was not complete, however, according to established medicolegal standards. A combination of strong Kennedy family desires to finish the autopsy quickly, a military environment that hindered independent action, a lack of experience in forensic pathology among the prosecutors, and a lack of established jurisdictional and procedural guidelines all contributed to the pathologists' failure to take certain measures essential to the completion of a thorough medicolegal autopsy and to competently perform the autopsy.

(96) The measures essential to a thorough medicolegal autopsy that the pathologists failed to take are:

1. Conducting the autopsy in an atmosphere free from the presence of individuals not necessary to any medical or investigative aspects of the autopsy. Aside from the Secret Service and FBI agents, it was not necessary for other military personnel to be in the autopsy room who were not performing a medical function.
2. Consulting the Parkland Hospital doctors who administered emergency treatment to the President before initiating the autopsy. According to the medical panel of the committee, such consultation is normal procedure.
3. Acquiring the assistance of an experienced pathologist engaged in the full-time practice of forensic pathology, as opposed to the consulting capacity Dr. Finck possessed. Such experienced assistance might have prevented several errors.
4. Recording precisely the locations of the wounds according to anatomical landmarks routinely used in forensic pathology. The medical panel of the committee stated that the reference points used to document the location of the wound in the upper back—the mastoid process and the acromion—are movable points and should not have been used.
5. Dissecting the wound that traversed the upper back of the President. The medical panel stated that probing a wound with a finger is hardly sufficient; to ascertain the actual track, the wound must be dissected.
6. Examining all organs and documenting the results of such examinations. Although the pathologists did examine most organs, they made no reference to the adrenal glands, part of the anatomy routinely examined during the autopsy.
7. Sectioning the brain coronally. Such documentation could have provided additional insight into the destructive impact of the missile in the brain.

(97) The committee recognizes that the inadequacies of the autopsy originated in part from the unique and hectic circumstances surrounding the death of the President, and not with any one source. Whatever the cause, however, these inadequacies have continued to feed the confusion and mistrust so long associated with the autopsy of President Kennedy and have reduced the effectiveness of the committee's review of the medical evidence. These problems reinforce the necessity for establishing substantive and procedural guidelines to be followed in the



performance of any autopsy stemming from the assassination of a national political official.

## REFERENCES

- (1) Letter from Capt. H. P. Miller, Medical Service Corps, U.S. Navy, Director, Administrative Services, to the House Select Committee on Assassinations, Sept. 22, 1977 (JFK Document No. 002590).
- (2) Report of the President's Commission on the Assassination of President Kennedy (Washington, D.C.: U.S. Government Printing Office, 1964), p. 53 (hereinafter "Warren Report").
- (3) *Id.* at p. 54.
- (4) *Ibid.*
- (5) Interview of Malcolm O. Perry, Jan. 11, 1978, House Select Committee on Assassinations, p. 2 (JFK Document No. 006186). See addendum I of sec. V of this volume for this document.
- (6) Testimony of Robert Nelson McClelland, Hearings before the President's Commission on the Assassination of President Kennedy (Washington, D.C.: U.S. Government Printing Office, 1964), vol. VI, p. 33 (hereinafter McClelland testimony, VI Warren Commission hearings, p. 33).
- (7) Testimony of William Kemp Clark, VI Warren Commission hearings, p. 20.
- (8) Warren Report, p. 55.
- (9) The Parkland doctors were providing emergency treatment to the President. Once the President died, their functions ceased. Further, after the President died, they believed it was beyond the scope of their duties to conduct any further action. (Warren Report, pp. 55-56).
- (10) *Id.* at p. 56.
- (11) Warren Report, p. 59.
- (12) FBI report, Bureau No. BA 89-30, Nov. 26, 1963, p. 3 (JFK Document No. 013618) (hereinafter cited as Sibert and O'Neill).
- (13) Testimony of Dr. James J. Humes, Sept. 7, 1978, hearings before the Select Committee on Assassinations, U.S. House of Representatives, 95th Cong., 2d Sess. (Washington, D.C.: U.S. Government Printing Office, 1979), vol. I, p. 323ff (hereinafter Humes testimony, Sept. 7, 1978, I HSCA-JFK hearings, 323ff).
- (14) *Id.* at p. 324.
- (15) Sibert and O'Neill, p. 1. See also staff interview of James W. Sibert, Aug. 29, 1977, House Select Committee on Assassinations, p. 1 (JFK Document No. 002191).
- (16) *Ibid.*, Sibert interview.
- (17) Sibert and O'Neill, p. 1.
- (18) *Ibid.*
- (19) *Ibid.*
- (20) Warren Report, p. 59.
- (21) *Ibid.* See also Humes testimony, II Warren Commission hearings, p. 349.
- (22) Sibert and O'Neill, p. 1.
- (23) Staff interview of J. Thornton Boswell, Aug. 16, 1977, House Select Committee on Assassinations, p. 1 (JFK document No. 002071).
- (24) Deposition of Pierre A. Finck, Mar. 11, 1978, House Select Committee on Assassinations, pp. 70-71 (JFK Document No. 013617).
- (25) Sibert and O'Neill, p. 3.
- (26) *Id.* at p. 2.
- (27) The Sibert and O'Neill report documented that Finck arrived after the autopsy had begun. Sibert and O'Neill, p. 2.
- (28) The Sibert and O'Neill report documented that O'Leary only remained in the autopsy room for a short time. Sibert and O'Neill, p. 2.
- (29) Staff interview of Richard A. Lipsey, Jan. 18, 1978, House Select Committee on Assassinations (JFK Document No. 014469).
- (30) Outside contact report, Samuel Bird, Feb. 17, 1978, House Select Committee on Assassinations (JFK Document No. 005541).
- (31) Sibert and O'Neill, p. 3.
- (32) Sibert and O'Neill, p. 1.
- (33) *Ibid.*
- (34) Humes testimony, II Warren Commission hearings, 349.
- (35) Outside contact report, James Curtiss Jenkins, June 27, 1978, House Select Committee on Assassinations, p. 1 (JFK Document No. 009526).
- (36) Staff interview of Francis X. O'Neill, Jan. 10, 1978, House Select Committee on Assassination, p. 3 (JFK Document 006185).

(37) Ibid.

(38) See reference 15, Sibert interview, p. 5.

(39) Outside contact report, John Thomas Stringer, Aug. 17, 1977, House Select Committee on Assassinations, p. 13 (JFK Document No. 003070).

(40) Staff interview of John Thomas Stringer, Aug. 17, 1977, House Select Committee on Assassinations, p. 17 (JFK Document No. 002070). See also affidavit of Dr. George C. Burkley, Nov. 28, 1978, House Select Committee on Assassinations, p. 2, in which Dr. Burkley said that the autopsy was to be a complete autopsy, with no limitations.

(41) Outside contact report, Capt. David Osborne, June 20, 1978, House Select Committee on Assassinations (JFK Document No. 013623).

(42) Affidavit of Francis X. O'Neill, Nov. 8, 1978, House Select Committee on Assassinations, p. 4 (JFK Document No. 013073). See reference 36, O'Neill interview, p. 3 (JFK Document No. 006185). See also p. 7, O'Neill affidavit, where he stated that he prepared this memorandum.

(43) See reference 41.

(44) Staff interview of Adm. Calvin B. Galloway, May 17, 1978, House Select Committee on Assassinations, p. 1 (JFK Document No. 009409).

(45) Humes testimony, I HSCA-JFK hearings, p. 324.

(46) Sibert and O'Neill, p. 3.

(47) See reference 40, Stringer interview.

(48) Outside contact report, Floyd Albert Riebe, Apr. 20, 1978, House Select Committee on Assassinations (JFK Document No. 007339).

(49) See reference 40, Stringer interview, p. 10.

(50) Id. at p. 11. Also blank letterhead memorandum, Nov. 22, 1963 (JFK Document No. 002504).

(51) The original number of film exposures listed on the receipt was in error and was changed by crossing out the typed notation and writing in the correct number. See U.S. Secret Service document, Dec. 5, 1963, which reflects this change.

(52) See reference 40, Stringer interview, p. 10.

(53) Sibert and O'Neill, p. 3.

(54) Deposition of James H. Ebersole, Mar. 11, 1978, House Select Committee on Assassinations, p. 4 (JFK Document No. 013617).

(55) Ibid.

(56) Id. at p. 9.

(57) Ibid.

(58) Receipt from Comdr. John H. Ebersole, MC, USN, acting chief of radiology, USNH, National Naval Medical Center, Bethesda, Md., to Roy H. Kellerman, agent, U.S. Secret Service, Nov. 22, 1963 (JFK Document No. 002504).

(59) Sibert and O'Neill, p. 4.

(60) Ibid., p. 3.

(61) Humes testimony, II Warren Commission hearings, 363.

(62) Sibert and O'Neill, p. 3. In their report, Sibert and O'Neill also stated that surgery had been performed on the head area prior to the arrival of the body at Bethesda Naval Hospital. The committee concludes that this report was in error. In an affidavit to the committee, Sibert acknowledged that the statement that head surgery was performed was determined "not to be correct following detailed inspection." See affidavit of James Sibert, Oct. 24, 1978, House Select Committee on Assassinations (JFK Document No. 012806).

(63) Sibert and O'Neill, p. 3.

(64) Autopsy protocol of President John F. Kennedy, Naval Medical School, Bethesda, Md., autopsy No. A63-272, Nov. 22, 1963, p. 4 (hereinafter cited as autopsy protocol).

(65) Id. at p. 3.

(66) Ibid.

(67) Sibert and O'Neill, p. 3.

(68) Ibid., p. 5.

(69) See a copy of the receipt which is attached to the affidavit of Chester H. Boyers, Dec. 4, 1978, House Select Committee on Assassinations (JFK Document No. 014834).

(70) Ibid., Boyers affidavit, p. 3. See also staff interview of Chester H. Boyers, April 25, 1978, House Select Committee on Assassinations (JFK Documents Nos. 013614 and 014462).

(71) Ibid.



- (72) Ibid.
- (73) See reference 42, O'Neill affidavit, p. 5, and reference 62, Sibert interview, p. 5. See also reference 36, p. 5; and reference 38, Sibert interview, p. 4.
- (74) Sibert and O'Neill, p. 4.
- (75) Autopsy protocol, p. 3.
- (76) Sibert and O'Neill, p. 4.
- (77) Humes testimony, II Warren Commission hearings, 363.
- (78) See reference 44, p. 2.
- (79) Autopsy protocol; supplemental autopsy report of President John F. Kennedy, Dec. 6, 1963 (hereinafter cited as supplemental autopsy report).
- (80) Humes testimony, II Warren Commission hearings, 363. See also interview of Dr. James J. Humes, Aug. 17, 1977, House Select Committee on Assassinations, p. 7 (JFK Document No. 003070).
- (81) See reference 40, Stringer interview, p. 40.
- (82) Interview of Dr. George C. Burkley, Aug. 17, 1977, House Select Committee on Assassinations, p. 4 (JFK Document No. 003070).
- (83) Sibert and O'Neill, p. 4.
- (84) See reference 62, Sibert affidavit, p. 4; and reference 15, Sibert interview, p. 4.
- (85) Sibert and O'Neill, p. 4.
- (86) Ibid.
- (87) Id. at p. 5.
- (88) Autopsy protocol, p. 4.
- (89) Deposition of John H. Ebersole, Mar. 11, 1978, House Select Committee on Assassinations, p. 5 (JFK Document No. 013617).
- (90) Autopsy protocol, p. 4.
- (91) Ibid.; Letter from Pierre A. Finck to Brig. Gen. J. M. Blumberg, MC, USA, director, Armed Forces Institute of Pathology, Feb. 1, 1965, p. 2.
- (92) See reference 80, Humes interview, p. 7; and Burkley interview, p. 4.
- (93) Humes testimony, II Warren Commission hearings, 349.
- (94) Dr. Humes emphasized in his open session testimony before the committee that there was one and only one bullet wound to the back of the President's head that it entered in the rear and that it exited in the front. Humes testimony, Sept. 7, 1978, I HSCA JFK hearings. See also Sibert and O'Neill, p. 5.
- (95) See reference 44, Galloway interview, p. 2. But see staff interview with Richard A. Lipsey, Jan. 18, 1978, House Select Committee on Assassinations (JFK Document No. 014469), in which Lipsey stated that he recalled the doctors concluding that three missiles struck the President from behind. Lipsey said that one bullet entered the upper back of the President and did not exit; one entered in the rear of the head and exited the throat; and one entered and exited in the right, top portion of the head, causing a massive head wound.
- The committee agreed that President Kennedy suffered a wound in the upper back, a wound in the rear of the head, a massive wound in the top, right side of the head, and a wound in the throat. Lipsey was wrong, however, in concluding that three shots struck the President and mistaken if he believed the pathologists reached such a conclusion. Only two shots struck the President: One entered the upper back and exited the throat. Another entered the rear of the head and exited on the top, right side of the head, causing the massive defect.
- Lipsey apparently formulated his conclusions based on observations and not on the conclusions of the doctors. In this regard, he believed the massive defect in the head represented an entrance and exit when it was only an exit. He also concluded that the entrance in the rear of the head corresponded to an exit in the neck. This conclusion could not have originated with the doctors, because during the autopsy they believed the neck defect only represented a tracheostomy incision. Lipsey did properly relate the preliminary conclusion of the doctors during the autopsy that the entrance wound in the upper back had no exit. The doctors later determined that this missile had exited through the throat. Thus, although Lipsey's recollection of the number of defects to the body and the corresponding locations are correct, his conclusions are wrong and are not supported by any other evidence.
- (96) Humes testimony, Sept. 7, 1978, I HSCA-JFK hearing.
- (97) Testimony of Roy H. Kellerman, II Warren Commission hearings, 100.
- (98) Deposition of Pierre A. Finck, Mar. 11, 1978, House Select Committee on Assassinations, p. 110 (JFK Document No. 013617).



- (99) Id. at p. 128.
- (100) Id. at p. 76.
- (101) Interview of James J. Humes, Sept. 16, 1977, HSCA, p. 67 (JFK Document No. 013616), reprinted as part of Addendum I to this report.
- (102) Interview of Gen. Godfrey McHugh, May 11, 1978, House Select Committee on Assassinations, p. 4.
- (103) Ibid.
- (104) Ibid.
- (105) Ibid.
- (106) See reference 101, Humes interview, Sept. 16, 1977, p. 66.
- (107) Id. at p. 73.
- (108) See reference 89, Ebersole deposition, p. 10.
- (109) See reference 40, Stringer interview, p. 13.
- (110) Ibid.
- (111) See reference 41.
- (112) Outside contact report, Paul K. O'Connor, June 28, 1978, House Select Committee on Assassinations (JFK Document No. 013613).
- (113) Ibid.
- (114) Ibid.
- (115) See reference 35.
- (116) Sibert and O'Neill, p. 3; see reference 112; see also reference 35.
- (117) See reference 41.
- (118) Ibid.
- (119) See reference 101, Humes interview, Sept. 16, 1977 p. 49.
- (120) Ibid.
- (121) Interview of Dr. Malcolm Perry, Jan. 11, 1978, House Select Committee on Assassinations, p. 8 (JFK Document No. 006370).
- (122) Id. at p. 2.
- (123) Id. at p. 8.
- (124) Autopsy protocol, p. 6.
- (125) See reference 101, Humes interview, Sept. 16, 1977 p. 51.
- (126) Ibid. See also Humes testimony, Sept. 7, 1978 I HSCA-JFK hearings. p. 330.
- (127) Ibid., Humes testimony, p. 331.
- (128) Admiral Galloway instructed Elsie B. Closson, his secretary, to type the autopsy report and the supplemental report because he believed he needed a typist with a top secret security clearance. See outside contact report, Elsie B. Closson, May 4, 1978, House Select Committee on Assassinations (JFK Document No. 008135).
- (129) See reference 101, Humes Interview, Sept. 16, 1977, p. 22.
- (130) Autopsy protocol, p. 16.
- (131) Supplemental autopsy report.



## SECTION III. CHAIN OF CUSTODY OF THE MATERIALS ACQUIRED DURING THE AUTOPSY

### PART I. INTRODUCTION

(98) Several of the physical materials—microscopic tissue slides, tissue sections of organs, bone fragments, and the brain—that the autopsy pathologists had acquired during the autopsy and retained for future examination, are unaccounted for today. The committee decided a thorough investigation into the medical evidence of the assassination required a diligent effort to locate and obtain these “missing” materials. Consequently, the committee traced the chain of custody of all materials (the “missing” physical items plus other material) derived from the autopsy, contacted all persons directly or indirectly associated with such custody, and investigated other possible theories regarding their fate.

(99) Despite these efforts, the committee was unable to determine precisely what happened to the materials. Circumstantial evidence indicates however, that it is possible that Robert F. Kennedy either destroyed or otherwise rendered them inaccessible.

### PART II. CHAIN OF CUSTODY OF THE AUTOPSY MATERIALS

(100) The disposition of the autopsy photographs, X-rays, and physical materials immediately following the autopsy was as follows:

#### *1. Photographs and X-rays*

(101) At the conclusion of the autopsy on the evening of November 22, 1963, Capt. John H. Stover, Jr., the commanding officer of the U.S. Naval Medical School, gave Secret Service Agent Roy H. Kellerman all the photographic film that the medical photographers had exposed during the autopsy. (1) Additionally, Comdr. John H. Ebersole, the acting chief of radiology, gave Kellerman all of the X-ray film. (2) In the early morning hours of November 23, Kellerman delivered this material to Robert I. Bouck, Special Agent in Charge of the Protective Research Division, U.S. Secret Service, which is located at the Executive Office Building, Washington, D.C. (the White House). (3)

(102) On or about November 27, Bouck instructed James K. Fox of the Secret Service to make arrangements with the Naval Processing Center located in Anacostia, Md. to process both the black and white and the color film. (4) Fox, along with Robert L. Knudsen, Mrs. Kennedy's personal photographer, proceeded to Anacostia that same day. (5) At the Naval Center, Lt. V. Madonna of the U.S. Navy processed both black and white negatives and color positives. (6) Fox returned the materials to Bouck the same day. (7) A few days later, under more instructions from Bouck, Fox made black and white prints from the negatives in the Secret Service laboratory, located at the Protective Research Division, Executive Office Building. (8)



(103) On December 9, Bouck directed Fox to take the color positives back to the Navy photographic laboratory and supervise the processing of enlarged color prints. (9) Fox returned all the color prints and positives to Bouck that evening. (10)

(104) Bouck and Edith Duncan, his administrative assistant, kept the photographic film and the X-ray films in a combination lock-safe file in the Protective Research Division of the Secret Service in the Executive Office Building, Washington, D.C. (11) The combination to the safe was known only to Bouck and Duncan. (12) From the early morning of November 23 until the transfer of the materials from the Executive Office Building in April 1965, the Secret Service maintained custody of the X-ray and photographic films. (13)

*2. Physical specimens retained during the autopsy or discovered at the scene of the assassination*

(105) On the day after the assassination, at about 5:30 p.m., William Allen Harper, a student at Texas Christian University, was taking photographs of the Dealey Plaza area. (14) when he discovered a piece of bone near the scene of the assassination. Harper informed the FBI that he took the bone to his uncle, Dr. Jack C. Harper, and that they both then went to Dr. A. B. Cairns, chief of pathology at Methodist Hospital, Dallas Tex. (15) Dr. Cairns believed the bone to be a piece of human skull. (16) William Harper said he then gave the specimen to Special Agent Anderton of the FBI on November 25. (17)

(106) Adm. George G. Burkley, the physician to the President, noted in an unaddressed memorandum on Nov. 27, 1963, that at 5:15 p.m. that day he received a small Neiman-Marcus box about 2½ by 3½ inches containing material which "had been discussed previously" with the FBI. (18) Dr. Burkley also wrote that this material would be deposited with the commanding officer of the Bethesda Naval Hospital for retention with other materials of a similar nature. (19)

(107) The evidence indicates that the Neiman-Marcus box contained the bone fragment William Harper discovered. First, the dimensions of the box and the Harper bone fragment (2¼ by 2½ inches) correspond. Second, the dates when William Harper gave the bone fragment to authorities and when Admiral Burkley referred to the Neiman-Marcus box in his memorandum are just 2 days apart. Third, William Harper gave the fragment to an FBI agent, and Admiral Burkley said the contact for receiving the box was the FBI. (20) Fourth, Admiral Burkley referred to the contents of the box as a specimen. (21) Consequently, it is logical that the Neiman-Marcus box contained the Harper bone fragment.

(108) In the same memorandum, Dr. Burkley also commented that Bouck had given him a specimen of bone, apparently on the same day, that was allegedly found in the parkway near the scene of the assassination. (22) Dr. Burkley noted that both of the above specimens were to be turned over to the Bethesda Naval Hospital for examination, analysis, and retention until other disposition was directed. (23) The committee does not know if this occurred.

(109) As mentioned earlier, the pathologists retained various sections of organs as well as the entire brain after the autopsy for subsequent microscopic examination. (24) In this regard, Captain Stover informed the committee that the pathologists placed the brain in a formaldehyde

solution in a stainless steel bucket and then deposited this in the closet of Admiral Galloway. (25) Stover also stated that the smaller portions of organs were retained in individual jars and then probably placed in the pathology department safe. (26) Dr. Burkley supported this information by informing the committee that he directed the "fixation and retention of the brain for future study." (27)

(110) The pathologists documented the results of the microscopic (gross) examination in a supplemental report. (28) Although the brain was not coronally sectioned, that is, sliced like a loaf of bread, the doctors did remove some sections. (29) Chester Boyers, one of the Navy personnel involved in the microscopic examination, informed the committee in an affidavit that he recalled preparing for analysis sections of organs on November 24, 1963, and the brain on December 2, 1963. (30) Neither Captain Stover nor Chester Boyers could recall what happened to these materials after this examination other than that Dr. Humes and Dr. Boswell, two of the autopsy pathologists, maintained possession of them at Bethesda Naval Hospital. (31) Stover also said that Dr. Burkley had control over the disposition of the materials. (32)

(111) In an affidavit and interview with Dr. Burkley, he informed the committee that shortly after this supplemental examination of the organs and brain, he directed the Bethesda Naval Hospital to transfer all the physical autopsy material in its possession to Bouck at the Executive Office Building. (33) Dr. Burkley stated further that Captain Stover gave him the brain in a white granite or stainless steel bucket and that he personally transferred it to the White House where it was placed in a locked Secret Service file cabinet. (34)

(112) Bouck corroborated this transfer in a memorandum dated April 26, 1965, in which he asserted that

[s]hortly after the assassination of President Kennedy, Adm. George C. Burkley delivered to this section certain specimens, photographs, and documents relating to the autopsy. (35)

(113) The evidence indicates, therefore, that soon after the autopsy of President Kennedy, all autopsy-related material was transferred from Bethesda Naval Hospital to the Executive Office Building where they were maintained in the custody of Bouck and under the control of Admiral Burkley. Specifically, this material included the autopsy photographs and X-rays, the bone fragments found in Dallas after the assassination, and the tissue sections of organs and brain. The Secret Service maintained custody of all of this material at all times until its transfer to the National Archives in 1965.

### PART III. SUBSEQUENT HISTORY OF MATERIALS

(114) On April 22, 1965, then Senator Robert F. Kennedy sent a letter to Dr. Burkley directing him to transfer in person the autopsy material being kept at the White House to Mrs. Evelyn Lincoln, the personal secretary of President Kennedy, for safekeeping at the National Archives. (36) The letter also said that Mrs. Lincoln was being instructed that the material was not to be released to anyone without Robert Kennedy's written permission and approval. (37) This demonstrates Robert Kennedy's firm control over the disposition of the materials.



(115) In response to this directive, Dr. Burkley notified the Protective Research Division of Senator Kennedy's request.(38) Before transferring the material, Bouck, Burkley and other Secret Service personnel carefully inventoried all the items present. (39) This was the first official inventory of these materials.

(116) On April 26, 1965, Burkley and Bouck transferred the materials to Evelyn Lincoln.(40) A letter from Burkley to Lincoln documenting the exchange included the inventory,(41) which documented that a stainless steel container 7 by 8 inches in diameter, containing gross material was transferred.(42) On the last page of the inventory, Lincoln wrote: "Received, April 26, 1965, in room 409, National Archives, Washington, D.C., from Dr. Burkley and Robert Bouck." (43) At the time of the transfer, the items now missing, which are those enumerated under item No. 9 of the inventory,(44) were allegedly present.

(117) In his testimony before the committee, Bouck stated that he is quite positive all the autopsy-related material that came into his possession was given to Mrs. Lincoln(45) at the time of the 1965 transfer. He also stated that he was uncertain whether Dr. Burkley had custody of the brain, but that if the brain was part of the autopsy materials in the custody of the Secret Service, it was transported to the National Archives.(46)

(118) Dr. Burkley clarified this issue, saying that the stainless steel container mentioned in the inventory held the brain and that he saw the bucket in April 1965, when he and Bouck transferred the autopsy materials to Lincoln.(47) Since this transfer, Dr. Burkley maintains that he has had no further knowledge of or association with these materials.(48)

(119) Mrs. Lincoln was not an employee of the National Archives during this period; she was only assisting in the transfer of the official papers and items of President Kennedy and in this capacity occupied an office in the National Archives.(49) Consequently, although the autopsy materials were in the confines of the building, the National Archives did not have authority or responsibility for them.(50)

(120) The next documented transaction involving the materials transferred to Mrs. Lincoln occurred on October 29, 1966, when Mr. Burke Marshall, on behalf of the executors of the John F. Kennedy estate, sent a letter to Lawson B. Knott, the Administrator of the General Services Administration, outlining an agreement for formal transfer of materials related to the autopsy to the U.S. Government.(51)

(121) Pursuant to this agreement, which constituted a deed of gift, Burke Marshall met with various representatives of the Government on October 31, 1966, in room 6-W-3 of the National Archives to transfer formally the materials related to the autopsy.(52) These materials were contained in a locked footlocker for which Ms. Angela Novello, the personal secretary to Robert F. Kennedy, produced a key.(53) Others in attendance for the transfer were William H. Brewster, special assistant to the general counsel, GSA, who unlocked and opened the footlocker; Harold F. Reis, executive assistant to the Attorney General; Robert H. Bahmer, Archivist of the United States; Herman Kahn, Assistant Archivist for Presidential libraries; and James B. Rhoads, the Deputy Archivist of the United States.(54)

(122) After Brewster opened the footlocker, Marshall and Novello departed.(55) Bahmer, Reis, Rhoads, Kahn, and Brewster then re



moved all the material from the footlocker and inspected it.(56) The footlocker contained a carbon copy of the letter from Robert F. Kennedy to Burkley on April 22, 1965, and the original letter from Burkley to Lincoln on April 26, 1965, which also listed on the itemized inventory list the materials present at that transfer.(57)

(123) Upon inspection, the officials realized that the footlocker did not contain any of the material listed under item No. 9 of the inventory.(58) This material included:

- 1 plastic box, 9 by 6½ by 1 inches, paraffin blocks of tissue sections.
- 1 plastic box containing paraffin blocks of tissue sections plus 35 slides.

A third box containing 84 slides.

- 1 stainless steel container, 7 by 8 inches in diameter, containing gross material.

- 3 wooden boxes, each 7 by 3½ by 1¼ inches, containing 58 slides of blood smears taken at various times during President Kennedy's lifetime.(59)

(124) The last date these items were accounted for was the April 26, 1965 transfer of the autopsy materials to Lincoln.

(125) The committee contacted Lincoln to determine what happened to the materials in item No. 9, the missing materials, following their documented transfer to her in April 1965. She informed the committee in an interview and subsequent affidavit that Burkley and Bouck brought her some materials in the spring of 1965 that Dr. Burkley identified as being related to the autopsy of the President.(60) She recalled that these materials arrived in a box or boxes, and that within 1 day she obtained a flat trunk or footlocker from the Archives personnel to which she transferred the materials.(61) She added that these materials were kept in a security room in her office in the National Archives.(62)

(126) Mrs. Lincoln stated that within approximately 1 month, Robert F. Kennedy telephoned her and informed her that he was sending Angela Novello, his personal secretary, to move the footlocker that Dr. Burkley had transferred.(63) She believed they wanted the materials moved to another part of the Archives, presumably where Robert F. Kennedy was storing other materials.(64) Angela Novello soon came to her office with Herman Kahn, Assistant Archivist for Presidential Libraries, and one or more of his deputies, to take the trunk.(65) Lincoln believes she had Novello sign a receipt for the materials, which was Lincoln's routine practice, but she is uncertain where it would be today.(66) Lincoln also said that she gave Novello both keys to the trunk.(67) She added that the trunk was never opened while it was in her office.(68)

(127) Lincoln had no further direct contact with the material, but did state that after the assassination of Robert Kennedy, she began to wonder what happened to it.(69) Consequently, she contacted Kenneth O'Donnell, former aide to President Kennedy, to make sure the family was aware of its existence. Mrs. Lincoln said it was her understanding that Mr. O'Donnell then called Senator Edward Kennedy, subsequently calling her back to tell her everything was under control.(70)

(128) Because of Lincoln's statement and other reports that Novello produced the key to the footlocker in December 1966, the committee interviewed Novello and also obtained an affidavit.(71) She informed

the committee that she had no recollection of handling a footlocker, of possessing a key or keys to such a footlocker, or of handling any of the autopsy materials.(72)

(129) The committee also contacted Burke Marshall and Senator Edward Kennedy to determine their knowledge of the missing materials. Senator Kennedy indicated that he did not know what happened to the materials, or who last had custody of them.(73)

(130) While Burke Marshall also maintained that he had no actual knowledge of the disposition of the materials, he said it was his speculative opinion that Robert Kennedy obtained and disposed of these materials himself, without informing anyone else.(74) Marshall said Robert Kennedy was concerned that these materials would be placed on public display in future years in an institution such as the Smithsonian and wished to dispose of them to eliminate such a possibility.(75) Marshall emphasized that he does not believe anyone other than Robert Kennedy would have known what happened to the materials and is certain that obtaining or locating these materials is no longer possible.(76)

(131) Since Marshall offered the opinion without any verification, the committee continued to search for the missing materials and to examine any issue related to the autopsy materials in general. The committee interviewed Harold F. Reis, Executive Assistant to the Attorney General who attended the 1966 transfer of the autopsy materials to the National Archives, as well as Ramsey Clark, the Attorney General in 1966, to determine their knowledge of the missing materials. Clark stated that he initiated the action to acquire the materials transferred in the October 1966 deed of gift pursuant to Public Law 89-318, enacted on November 2, 1965.(77) This law provided that the acquisition by the United States of certain items of evidence pertaining to the assassination of President Kennedy had to be completed within 1 year.(78) When Clark learned the time limit for obtaining the evidence was approaching, he contacted Robert Kennedy, who was not sympathetic to the Government's need to acquire the autopsy material.(79) Rather heated negotiations ensued between Clark and Burke Marshall, the Kennedy family representative, which resulted in the October 29, 1966 agreement constituting the deed of gift.(80) Clark stated that he had only requested transfer of the autopsy photographs and X-rays and did not recall any discussions with Robert Kennedy about any other autopsy materials.(81) Consequently, the brain and the tissue segments were not an issue in the procedures and negotiations during the October 1966 transfer. The committee could not ascertain if the physical specimens were ever discussed in the negotiations, what type of approval Robert Kennedy gave for transferring the materials, or what procedure was employed to separate the photographs and X-rays from the material now missing.

(132) The next reference to the missing materials and the other autopsy materials in the custody of the National Archives occurred in 1968. Ramsey Clark, the Attorney General, arranged for an independent review of the autopsy evidence by a group of pathologists—commonly referred to as the Clark panel—as a result of growing skepticism concerning the assassination and Warren Commission investigation.(82) In a memorandum to the files on February 13, 1969, Thomas J. Kelley, the Assistant Director of the Secret Service, reflected on the



report of the Clark panel, in which the physicians had commented that the materials they reviewed were included on the inventory list that accompanied the letter from Burkley to Lincoln on April 26, 1965.(83) Kelley asserted that this reference to the autopsy materials by the Clark panel physicians was phrased in this manner because the doctors did not have access to the materials listed as comprising item No. 9 on the inventory list.(84) The memorandum also noted that after discovering in October 1966 that these items were missing, Archives personnel conducted a careful search but could not determine their location.(85)

(133) After discussing the "missing" materials with Harry R. Van Cleve, Jr., General Counsel to the General Services Administration, and agreeing that they should attempt to ascertain their disposition, Kelley said he would contact Dr. Burkley.(86) Kelley's memorandum related the following:

[T]hat after turning all of this material over to Mrs. Lincoln [on April 26] [Burkley] never saw nor heard anything about its disposition, and that he was surprised to hear that it was not with the remainder of the material he turned over to Mrs. Lincoln. After discussing the problem, Dr. Burkley offered to call Mrs. Lincoln. He did this in my presence and Mrs. Lincoln told him that all of the material he turned over to her was placed in a trunk or footlocker; that it was locked, and that to her knowledge it was never opened nor the contents disturbed by her. She said, however, that sometime after its receipt all of the material concerning the assassination, with which she was working, was turned over to Angie Novello, Robert Kennedy's secretary.(87)

(134) The memorandum further related that Dr. Burkley told Kelley that Henry Giordano, a former White House driver, was working with Lincoln at the time of the transfer and was then employed in Senator Kennedy's office.(88)

(135) After contacting Van Cleve again and advising him of the contact with Burkley, Kelley related the following:

I \* \* \* further advised him that, in my opinion, we should not contact Giordano. He agreed with this and stated he felt that the inquiry would have to remain as it now stands; that perhaps we were borrowing trouble in exploring it any further, and assured me that the Archivist had made a thorough search of all of the material on hand to make sure that the material in question had not been received by the Archivist at another time or under other circumstances.(89)

(136) Thus, the General Services Administration, which oversees the National Archives, decided not to pursue the search for the missing materials any further. The officials involved were apparently satisfied with knowing that the National Archives did not have any responsibility in their disappearance and did not wish to instigate trouble by pursuing any investigation.

(137) In 1971, a controversy, not directly involving the missing materials, arose over the chain of custody of the autopsy materials being stored in the National Archives and who should have access to them.



John Nichols, a pathologist, began court proceedings in the Federal courts, challenging the agreement of October 29, 1966, which contains several restrictions limiting public access to the autopsy materials.(90) An issue raised by the suit was whether the Kennedy family ever had any legal right to control the autopsy materials at any time and, consequently, whether any deed of gift from the family which contained restrictions limiting public access could be valid.(91)

(138) Both the Federal District Court and the Tenth Circuit Court of Appeals upheld the agreement.(92) The court of appeals stated that the "letter of agreement of October 29, 1966 is a valid, binding agreement and that the restrictions imposed thereby are reasonable."(93)

(139) The legal department of the Congressional Research Service analyzed the *Nichols* case for the committee. The CRS noted that while the "*Nichols* decision represents only the determination of one circuit. until the question is addressed elsewhere it would seem to represent 'the state of the law.'"(94) The CRS stated that until the April 1965 transfer, the autopsy materials were "in Government hands with no intervening transfer of like having occurred."(95) It then observed:

At this point, however, as suggested in the November 4, 1966, Treasury Department memorandum \* \* \* the transfer to the Kennedy family may have been interpreted by some as indication of U.S. recognition of Kennedy family rights in the items so transferred. At some point thereafter, either upon delivery to the Archives in 1965 or upon acceptance of the letter of gift of October 1966, the materials may be regarded as having been either (1) returned to their rightful owner, the United States Government, or (2) donated by properly executed deed of gift to the United States, thereby resulting in relinquishment of Kennedy family rights in them.(96)

(140) The CRS ended by saying that two conclusions are irrefutable. First, the autopsy photographs and X-rays are now the property of the United States; and second, the letter of agreement between the Government and the Kennedy family remains enforceable.(97)

(141) The committee also interviewed Archives personnel to ascertain their present position regarding the missing materials. In response to committee requests, Trudy H. Peterson, Assistant to the Deputy Archivist of the United States, prepared a written statement.(98) In this document, Peterson noted that just prior to the October 1966 transfer of the materials to the Archives, the locked footlocker was brought to the National Archives building, although she does not specify from where.(99) This suggests that after Novello allegedly took the material from the office of Mrs. Lincoln, it may have been removed from the Archives building as opposed to only being moved to another part of the building as Mrs. Lincoln speculated.(100) Peterson also says that Robert Bahmer, the Archivist of the United States in 1966, believed that sometime before the transfer of the materials as a gift, Herman Kahn, the Assistant Archivist for Presidential Libraries supervised the acceptance of the footlocker, along with several other boxes of Robert Kennedy's materials, for courtesy storage in vault 6-W-3.(101) Peterson further stated that Herman Kahn, now dead, may have been the only Archives employee present for the transfer and that no record of delivery is available.(102)

(142) In response to a subsequent committee inquiry concerning Herman Kahn, Peterson stated that Kahn dealt with members and representatives of the Kennedy family during 1964-68 on numerous issues, including the courtesy storage of Robert Kennedy materials. (103) He was present for the October 1966 transfer and, according to Marion Johnson of the National Archives, was one of the original holders of the combination to the safe cabinet in which the autopsy material was stored. (104) Kahn also allegedly accompanied Novello when Novello apparently removed the autopsy materials from the office of Lincoln. (105)

(143) In response to another committee request, the Office of Presidential Libraries conducted a thorough but unsuccessful search of the office files for 1965-66 for documentation regarding the transfer of the autopsy materials to the physical custody of the Archives. (106) Additionally, two members of the Presidential Libraries staff who worked under Herman Kahn at that time stated in interviews and affidavits that they could not recall any pertinent details concerning the autopsy materials. (107) The staff of the John F. Kennedy Library also reviewed their files, with negative results. (108) Further, one Archives employee, Marion Johnson, Archivist, Office of the National Archives, National Archives and Records Service, remembered that he became aware of the footlocker containing the autopsy materials shortly before the October 31, 1966 transfer, but was not aware of its contents until after the transfer. (109) Additionally, at the request of the committee, on July 18, 1978, Clarence Lyons and Trudy Peterson conducted a thorough but unsuccessful search of the security storage vault for the tissue sections and the container of gross material. (110)

(144) Given these efforts and findings, it appears that Kahn and Novello removed the autopsy material from the office of Mrs. Lincoln shortly after April 1965. The material was then either kept in another part of the Archives, probably a Robert Kennedy courtesy storage area, or removed from the building to a location designated by Robert Kennedy. The circumstantial evidence would seem to indicate that Robert Kennedy then decided to retain possession of all physical specimen evidence and transferred only the autopsy photographs and X-rays to the Government. The committee has not been able to verify how or when the item No. 9 materials were removed from the other autopsy materials or what subsequently happened to them.

#### PART IV. ADDITIONAL EFFORTS TO ACQUIRE THE MISSING MATERIALS

(145) After failing to determine the fate of the missing materials by tracing that chain of custody, the committee investigated the possibility that someone had placed the missing autopsy items, all of which were physical specimens taken from the body of President Kennedy, in the final grave on reinterment, on March 14, 1967. (111) The persons contacted who were present for the ceremony could not recall any additional package or material being placed in the grave. The Superintendent of Arlington National Cemetery from 1951 to 1972, John Metzler, informed the committee that he attended the burial of the President and the reinterment. (112) At the time of burial, the coffin was placed in a "Wilbur" vault, which has a lid and vault that op-



erate on a tongue and groove system. Tar is placed on the points of contact of the grooves to insure a tight fit and permanent seal. (113) Metzler witnessed the lowering of the lid and the sealing of the vault. (114) and believed that the only method to open the vault subsequently would be to break the lid on the main portion of the vault. (115)

(146) Metzler supervised the reinterment in 1967 and was present at all phases of the transfer: from the opening of the old site through the transfer by crane of the vault to the closing of the new site (116) Metzler said there was no way anyone could have placed anything in the coffin or vault during the transfer without his seeing it. (117) Metzler also said that nothing could have been placed in the vault since 1963 because there was no indication of damage to the vault indicating any disturbance. (118) Metzler stated further that no one placed anything in the new or old gravesite besides the vault. (119) (147) In the course of its investigation the committee contacted numerous other people in an unsuccessful attempt to locate the missing materials. They included:

1. Dr. James J. Humes, autopsy pathologist;
2. George Dalton, former White House aide and assistant to Mrs. Lincoln at the National Archives;
3. Edith Duncan, administrative assistant to Robert Bouck, Protective Research Section, Secret Service;
4. Joseph D. Giordano, former White House aide and assistant to Mrs. Lincoln at the National Archives;
5. Frank Mankiewicz, former assistant to Robert F. Kennedy;
6. Harry Van Cleve, former General Counsel of the General Services Administration;
7. Lawrence O'Brien, former aide to President Kennedy;
8. David Powers, former aide to President Kennedy;
9. Ken Fienberg, aide to Senator Edward Kennedy;
10. P. J. Costanzo, Superintendent of Arlington National Cemetery;
11. Dr. James Boswell, autopsy pathologist;
12. Dr. Pierre Finck, autopsy pathologist;
13. Adm. George Galloway, commanding officer of the National Naval Medical Center in 1963;
14. Capt. John H. Stover, commanding officer of the U.S. Naval Medical School in 1963;
15. Bruce Bromley, former Justice Department attorney who was called briefly from private practice to serve as counsel to the Clark panel;
16. Carl Eardley, former Justice Department official;
17. Harold Reis, former Justice Department official;
18. Sol Lindenbaum, former Justice Department official;
19. National Archives personnel; and
20. Thomas J. Kelley, Assistant Director of the U.S. Secret Service.

## PART V. CONCLUSIONS

(148) Despite these efforts, the committee was not able to determine precisely what happened to the missing materials. The evidence indicates that the materials were not buried with the body at reinterment. It seems apparent that Angela Novello did remove the footlocker con-



taining the materials from the office of Mrs. Lincoln at the direction of Robert Kennedy, and that Herman Kahn had knowledge of this transaction. After the removal from Lincoln's office, Robert Kennedy most likely acquired possession of or at least personal control over these materials. Burke Marshall's opinion that Robert Kennedy obtained and disposed of these items himself to prevent any future public display supports this theory.

(149) There are at least two possible reasons why Robert Kennedy would not have retained the autopsy photographs and X-rays. First, the only materials retained were physical specimens from the body of his brother: Tissue sections, blood smear slides, and the container of gross material. He may have understandably felt more strongly about preventing the misuse of these physical materials than the photographs and X-rays. Second, the Justice Department under Ramsey Clark pushed hard to acquire the photographs and X-rays but did not request the physical materials. Even if Robert Kennedy had wished to prevent the release of all the autopsy materials, he was not in a position to do so when confronted with Justice Department demands.

(150) Consequently, although the committee has not been able to uncover any direct evidence of the fate of the missing materials, circumstantial evidence tends to show that Robert Kennedy either destroyed these materials or otherwise rendered them inaccessible.

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- (2) Ibid.
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- (4) Memorandum from James K. Fox, photographer, intelligence division, U.S. Secret Service, Feb. 16, 1967 (JFK Document No. 014879).
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- (6) See reference 1, the letter from Rowley to Sanders, p. 2.
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- (9) Id. at p. 2.
- (10) Id. at p. 3.
- (11) Id. at p. 2.
- (12) Ibid.
- (13) Id. at p. 1.
- (14) FBI report, Nov. 25, 1963, Dallas, Tex., file No. DL 89-43, p. 150-A.
- (15) FBI memorandum, June 14, 1964, Dallas, Tex., entitled "Lee Harvey Oswald," pp. 2 and 5.
- (16) Id. at p. 5.
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(26) Ibid.

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(28) Supplemental autopsy report of President John F. Kennedy, Bethesda Naval Hospital, A63-272, Dec. 6, 1963.

(29) Ibid. These sections were taken from tissue areas surrounding the missile path. The brain was not, however, sectioned coronally, a normal forensic autopsy procedure.

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(31) Affidavit of Chester H. Boyers, Dec. 4, 1978, House Select Committee on Assassinations, p. 4 (JFK Document No. 014834) : outside contact report of John H. Stover, May 11, 1978, House Select Committee on Assassinations (JFK Document No. 013615).

(32) Outside contact report of John H. Stover, Nov. 28, 1978, House Select Committee on Assassinations (JFK Document No. 013315).

(33) Affidavit of George G. Burkley, Nov. 28, 1978, House Select Committee on Assassinations, p. 3 (JFK Document No. 013416).

(34) Ibid.

(35) Secret Service memorandum from Robert I. Bouck to the chief of the Protective Research Service, Apr. 26, 1965 (JFK Document No. 002504).

(36) Letter from Robert F. Kennedy to George G. Burkley, U.S. Senate letterhead, Apr. 22, 1965.

(37) Ibid.

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(39) Ibid.

(40) Letter from George G. Burkley to Mrs. Evelyn Lincoln, White House letterhead, with attached inventory list, White House letterhead, Apr. 26, 1965.

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(53) Ibid.

(54) Ibid.

(55) Ibid.

(56) Ibid.

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(59) See reference 40, letter from Burkley to Lincoln.

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- (61) Ibid., Lincoln affidavit, p. 2.
- (62) Ibid.
- (63) Id. at p. 3.
- (64) Ibid.
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- (66) Ibid.
- (67) Id. at p. 7.
- (68) Ibid.
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- (90) See reference 51, Library of Congress memorandum, p. 7. See also *Nichols v. United States*, 325 F. Supp. 130 (D. Kansas, 1971), affirmed, 460 F. 2d 671 (10th Cir., 1972), cert. denied, 409 U.S. 966 (1972).
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## SECTION IV. AUTHENTICITY

### PART I. INTRODUCTION

(151) At the outset of the investigation into the issues concerning the medical evidence, the committee determined that experts should examine the autopsy photographs and X-rays for two purposes: First, to establish or repudiate their authenticity (whether they are photographs and X-rays taken of President Kennedy at the time of his autopsy); and second, to determine whether anyone altered or "doctored" them. Such examinations were essential to the analysis of consultants whom the committee charged with interpreting the medical evidence, since their conclusions were to be based principally on the evidence derived from the autopsy photographs and X-rays.

(152) The committee also wanted these examinations conducted as one way to resolve the varying accounts of where the wounds to the President were situated. If the photographs and X-rays were proven to be authentic and unaltered, then any account of the President's wounds which differed from what they showed would be incorrect. Conversely, if the photographs or X-rays or both were proven to be fake or altered, they might then provide a clue which would assist in determining which account of the injuries was correct.

(153) The various accounts of the nature of the wounds to the President differ significantly. As revealed in section 2 of this volume, "Performance of the Autopsy," eyewitness descriptions of the wounds, as described by staff at Parkland Memorial Hospital, differed from those in the autopsy report, as well as from what appears in the autopsy photographs and X-rays. (1) Further, the reports of FBI agents Sibert and O'Neill referred to "surgery" of the head area being evident when the body arrived for the autopsy, (2) yet no surgery of the head area was known to have been performed. Finally, the Clark panel--the panel of experts assembled in 1968 by then-Acting Attorney General Ramsey Clark--said the entrance wound in the President's head was 10 centimeters (almost 4 inches) higher than was described by the autopsy pathologists. (3)

(154) Critics of the Warren Commission's medical evidence findings have found on the observations recorded by the Parkland Hospital doctors. (4) They believe it is unlikely that trained medical personnel could be so consistently in error regarding the nature of the wounds, even though their recollections were not based on careful examinations of the wounds.

(155) In disagreement with the observations of the Parkland doctors are the 26 people present at the autopsy. All of those interviewed who attended the autopsy corroborated the general location of the wounds as depicted in the photographs; none had differing accounts. (5) Further, in 1967 the autopsy pathologists, Drs. Humes, Boswell, and Finck, as well as Dr. James H. Ebersole, the acting chief

of radiology, and one of the autopsy photographers, John Thomas Stringer, viewed the autopsy photographs or X-rays, or both, and verified them as accurately portraying the wounds of President Kennedy.(6)

(156) Aside from using scientific analysis to determine authenticity and verify that no alterations had been made, the committee also considered what reasonably might have happened. It assumed that if the Parkland doctors are correct, particularly with respect to the gaping hole in the back of the President's head, then it would mean: (1) The autopsy photographs and X-rays had been doctored to conceal this hole; (2) the body itself had been altered, either before its arrival at Bethesda or during the autopsy so that the hole was not obvious in the photographs and X-rays; or (3) the photographs and X-rays were not of President Kennedy. Further, if the Parkland doctors are correct, then the autopsy personnel are incorrect and either lying or mistaken.

(157) It did not seem plausible to the committee that 26 persons would be lying or, if they were, that they could provide such a consistent account of the wounds almost 15 years later. Second, it is less likely that the autopsy personnel would be mistaken in their general observations, given their detailed and thorough examination of the body. Consequently, it seems reasonable to assume that the autopsy personnel were correct.

(158) If the autopsy doctors are correct, then the Parkland doctors are incorrect and either lying or mistaken. It does not seem probable that they are lying, because it would be difficult to maintain a conspiracy of lying among the approximately 14 persons involved for 15 years. On the other hand, it does seem possible, that the Parkland personnel could be mistaken, given their cursory observations of the wounds, the brief period of time they examined the President, and their function at the time: To administer emergency procedures to save the life of the President, rather than to document the nature and location of his wounds.

(159) The theoretical possibility also exists that both Parkland and the autopsy personnel are correct in their observations and that the autopsy photographs and X-rays accurately reflect the observations of the autopsy personnel. This could have occurred if someone had altered the body while in transit from Parkland Memorial Hospital to Bethesda Naval Hospital. This possibility however, is highly unlikely or even impossible. Secret Service agents maintained constant vigilance over the body from Parkland to Bethesda and stated that no one alter the body.(7) Second, if such alterations did occur, it seems likely that the people present at the autopsy would have noticed them; in which case they are now lying about their observations. As stated previously, this does not appear likely.

(160) A further complicating factor could be the possibility that all persons are somewhat mistaken in their observations or their memories of them and that the autopsy photographs and X-rays do not portray the wounds in sufficient detail to resolve the matter. This possibility would not, however, account for the major disagreement between the Parkland and autopsy personnel: A large, gaping wound in the rear of the head.



(161) Consequently, without considering any scientific analysis to evaluate authenticity and any possibility of the autopsy photographs and X-rays having been altered, it appears more probable that the observations of the Parkland doctors are incorrect.

## PART II. PROCEDURES EMPLOYED IN EXAMINING THE AUTOPSY PHOTOGRAPHS AND X-RAYS

(162) As mentioned, the committee did, however, subject the autopsy photographs and X-rays to scientific analysis. These examinations by the committee's consultants established the inaccuracy of the Parkland observations. The experts concluded that the autopsy photographs and X-rays were authentic and unaltered, confirming the observations of the autopsy personnel and providing additional support for the conclusions of the medical consultants.

(163) From the beginning, the committee's investigative approach in the medical evidence area was to assume nothing about the authenticity of the photographs and X-rays. To conduct the analyses to determine whether the photographs and X-rays could be identified as being of the President and whether they were altered, the committee retained experts in the following areas: Anthropology, forensic dentistry, photographic interpretation, forensic pathology, and radiology.

(164) Anthropologists studied the autopsy photographs in an attempt to verify the consistency of the subject matter, specifically, whether the photographs of the rear of the head could be identified as being consistent with photographs of other views of the head in which the President's facial features are recognizable. The anthropologists determined that the posterior photographic views of the head are identifiable as part of the same head as is visible in the side or front views and hence concluded that the posterior views are photographs of President Kennedy.(8)

(165) The anthropologists also studied the autopsy X-rays in comparison with premortem X-rays of President Kennedy, obtained from the Kennedy Library in Waltham, Mass.(9) The premortem X-rays had been collected by the Library from a number of different sources (10) over a period of a couple of years.(11)

(166) By studying the premortem X-rays, the anthropologists were able to observe a number of unique anatomic characteristics whose absence or presence among the autopsy X-rays would, in their opinion, be determinative of whether the two sets of X-rays were of the same person.(12) Some of the anatomic characteristics they noted included: turcica, cranial sutures, vascular grooves and the air cells of the mastoid bone.(13) The anthropologists were able to observe enough of these anatomical features among the autopsy X-rays to conclude that the autopsy and premortem X-rays were taken of the same individual.(14)

(167) The committee also retained an expert in dental comparison, Dr. Lowell Levine, a forensic odontologist(15) experienced in the identification of victims of unnatural death, including, for example, individuals killed in airplane crashes. Dr. Levine also compared premortem X-rays with the autopsy X-rays. He was confident in his conclusion that the three autopsy skull X-rays are identifiable as being

of the same person as the premortem dental X-rays of President Kennedy. (16) Dr. Levine presented his conclusions in his public testimony before the committee on September 7, 1978.

(168) Once it was determined that the autopsy photographs and X-rays were of the President, the committee used relevant scientific expertise to look for evidence of alteration. Different techniques were used for studying the photographs and X-rays.

(169) Members of the committee's photographic panel carefully studied the autopsy photographs, negatives and transparencies. (17) There were a number of features the panel members noticed that were relevant to the issue of authenticity, including: emulsion numbers on the films, a pentagonal shaped light spot, and a number of sets of photographic stereo pairs. (18)

(170) On April 8, 1978, David Eisendrath contacted Kodak to determine what information, if any, could be gleaned from the numbers visible on the autopsy films. (19) David Greenlaw responded for Kodak on June 8, 1978, providing information that indicated the numbers matched emulsion batches produced in 1963 and, in one film type, an operator number which was discontinued in 1969. (20)

(171) Several stereo pairs which the panel observed among the autopsy photographs were suitable for stereoscopic viewing. A stereo pair is created when the photographer takes two pictures of a particular scene with either the camera or the object in slightly different position. According to Scott, (21)

A pair of stereo pairs enables one to see the scene in three-dimensions; stereo pictures add depth to the perception of the photographed scene in much the same way as a pair of human eyes, separated from one another in space, can perceive depth.

(172) Also according to Scott, stereoscopic viewing heightens the ability of the human eye to perceive differences between the two photographs of a stereo pair:

To successfully avoid detection of picture alteration requires that each picture of a pair of pictures be altered identically, which is essentially impossible, particularly with a stereo pair \* \* \* Any nonidentical alteration of the pictures of a pair is readily noted when pairs are viewed stereoscopically or microscopically. (22)

(173) Fortunately, the autopsy photographer had taken two or more pictures of each scene, some of which were stereo pairs because of slight differences. (23)

(174) Scott believed there were pairs of autopsy photographs that provided sufficient stereoscopic viewing quality to permit the conclusion of authenticity, including: The back of the head (Nos. 42 and 43), top of the head (Nos. 32 and 33, and Nos. 34 and 37), the large skull defect (Nos. 44 and 45), and the head from the front right (Nos. 26 and 28). (24)

(175) Scott said that in these he "\* \* \* did not find any indication or evidence that any of the pictures were altered \* \* \*" and thus concluded that the photographs for which there were stereo pairs "\* \* \* are authentic photographs." (25)



(176) Calvin McCamy, a photogrammetrist, testified in public session of the select committee on September 7, 1978, on behalf of the photographic evidence panel on the issue of the authenticity of autopsy photographs. He agreed with Scott's assessment of the authenticity of the stereophotographic views and added that in his analysis, he found additional stereo pairs permitting the additional conclusions that the photographs of the back wound (Nos. 38 and 39) and of the anterior neck wound (Nos. 40 and 41) are authentic. (26)

(177) Dr. Gerald McDonnel examined the premortem and post-mortem X-rays for evidence of alteration. (27) He reported that an alteration of the images " \* \* \* should be readily \* \* \*" discernible in a number of ways:

- a. Observation of a difference in density of the images,
- b. Discontinuity of anatomical structures,
- c. Alteration of continuity of an abnormal pattern, or
- d. Production of an image which is not anatomical or an image of an impossible pathologic process. (28)

(178) Dr. McDonnel concluded that "[t]he radiologic images both ante mortem and post mortem, have not been altered in any fashion \* \* \*" except for two small areas of thermal damage and "minor \* \* \* discoloration of the images due to incomplete processing of the film \* \* \*". Neither of these conditions affected the conclusion that the images were not altered " \* \* \* to provide a false image \* \* \*" nor " \* \* \* to produce misinformation and therefore improper conclusions." (29)

For further explanation of the authenticity of the autopsy photographs and X-rays, see paragraphs 512-604 of the Report of the Photographic Evidence Panel.

### PART III. CONCLUSIONS

(179) From the reports of the experts' analyses of the autopsy photographs and X-rays, the evidence indicates that the autopsy photographs and X-rays were taken of President Kennedy at the time of his autopsy and that they had not been altered in any manner.

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(5) Staff interviews with persons present at the autopsy, House Select Committee on Assassinations. For citations to these reports, see generally sec. II of this volume, "Performance of the Autopsy," paras. 42-94.

(6) Blank letterhead memorandum, Jan. 26, 1967, from James J. Humes, M.D., J. Thornton Boswell, M.D., pursuant to a Department of Justice request to examine the autopsy photographs and X-rays; blank letterhead memorandum entitled, "Report of Inspection by Naval Medical Staff on November 1, 1966, at National Archives of X-Rays and Photographs of Autopsy of President John F. Kennedy," signed James J. Humes, M.D., J. Thornton Boswell, M.D., John H. Ebersole, M.D., and John T. Stringer, Nov. 10, 1966.



(7) Outside contact report, William Greer, Dec. 4, 1978, House Select Committee on Assassinations (JFK Doc. No. 014880); Outside contact report, Roy H. Kellerman, Dec. 1, 1978 (JFK Doc. No. 013394).

(8) John F. Kennedy Autopsy Authentication, a report to the House Select Committee on Assassinations by Ellis R. Kerley, Ph. D., and Clyde C. Snow, Ph. D., Feb. 9, 1979, pp. 1-2.

(9) Authentication of John F. Kennedy Autopsy Radiographs and Photographs, a report to the Select Committee on Assassinations, U.S. House of Representatives, by Ellis R. Kerley, Ph. D., and Clyde C. Snow, Ph. D., Feb. 28, 1979, p. 1, Lowell J. Levine, D.D.S., "Identification of the Skull X-ray Films Taken During the Autopsy of President John F. Kennedy." Sept. 7, 1978, p. 5. Levine's report is contained in volume I, pp. 153-176, of the hearings before the House Select Committee on Assassinations, 95th Cong., 2d sess. (Washington, D.C.: U.S. Government Printing Office, 1979).

(10) Some of the premortem dental films were supposed to have been taken by Robert D. Morris, D.D.S., 140 East 54th St., New York, N.Y. In a telephone interview between Dr. Levine and Dr. Morris, Dr. Morris confirmed that he had taken X-rays of the President on the date indicated on the X-ray films. See reference 9, Levine report, pp. 9, 16.

(11) Id. at p. 5.

(12) See reference 8, Kerley and Snow report, pp. 1-2.

(13) Id. at pp. 2-4.

(14) Id. at p. 4.

(15) See reference 9, Levine report, pp. 1-4, for a discussion and description of the function of a forensic odontologist (dentist).

(16) Id. at p. 20.

(17) Letter from Frank Scott to House Select Committee on Assassinations, Aug. 15, 1978. Testimony of Calvin S. McCamy, Sept. 7, 1978, Hearings Before the Select Committee on Assassinations, U.S. House of Representatives, 95th Cong., 2d sess. (Washington, D.C.: U.S. Government Printing Office, 1979), vol. I, p. 176 (hereinafter referred to as McCamy testimony, Sept. 7, 1978, I HSCA-JFK hearings, 176).

(18) Letter to Michael Goldsmith, from David B. Eisendrath, June 10, 1978, House Select Committee on Assassinations (JFK Doc. 009129); letter to Jane Downey from David B. Eisendrath, Oct. 23, 1978, House Select Committee on Assassinations, (JFK Doc. No. 012845); see reference 17, McCamy testimony, Sept. 7, 1978, I HSCA-JFK hearings, 176.

(19) Letter from David B. Eisendrath, to David S. Greenlaw, director, Corporate Commercial Affairs Eastman Kodak Co., Apr. 8, 1978, House Select Committee on Assassinations (JFK Doc. No. 012845).

(20) Letter from David S. Greenlaw, assistant vice president, Corporate Commercial Affairs, Eastman Kodak Co., to David B. Eisendrath, June 8, 1978, House Select Committee on Assassinations (JFK Doc. No. 009129).

(21) Letter to Jane Downey from Frank Scott, Aug. 15, 1978, House Select Committee on Assassinations p. 1.

(22) Id. at p. 2.

(23) Id. at p. 1.

(24) Id. at p. 4.

(25) Id. at p. 3.

(26) McCamy testimony, Sept. 7, 1978, I HSCA-JFK hearings, pp. 176-179.

(27) Report of G. M. McDonnell, M.D., concerning observation, analysis, and conclusions in connection with radiographic images and enhanced images attributed to President John F. Kennedy, Aug. 4, 1978. See addendum C of the Forensic Pathology Panel Report (sec. V of this volume) for this document.

(28) Report of G. M. McDonnell, M.D., Mar. 8, 1978, p. 4. See addendum C of the Forensic Pathology Report (sec. V of this volume) for this document.

(29) Ibid.

## (180) ADDENDUM A

### AUTHENTICATION OF JOHN F. KENNEDY AUTOPSY RADIOGRAPHS AND PHOTOGRAPHS

Final Report to the Select Committee on Assassinations, U.S. House  
of Representatives—March 9, 1979

Ellis R. Kerley, Ph. D.<sup>1</sup>

Clyde C. Snow, Ph. D.<sup>2</sup>

#### BOARD OF ANTHROPOLOGY CONSULTANTS, PHOTOGRAPHIC PANEL, HOUSE SELECT COMMITTEE ON ASSASSINATIONS

Various conspiracy theorists have questioned the authenticity of the post mortem radiographs and photographs taken during the autopsy of President John F. Kennedy at the U.S. Naval Hospital on November 22, 1963. The anthropology consultants were asked by the committee to examine these materials and, if scientifically possible, determine whether or not they were indeed those of the late President. Our approach to this problem was through the comparison of the post mortem X-rays and photographs with those known to have been taken prior to his death.

#### AUTHENTICATION OF X-RAYS

##### *Introduction*

It is a well-established fact that human bone structure varies uniquely from one individual to another. The bones not only differ in their overall size and shape, but also in their minute structural details so that the total pattern of skeletal architecture of a given person is as unique as his or her fingerprints. Forensic anthropologists have long made use of this fact in establishing the positive identification of persons killed in combat, aircraft accidents, or other disasters, by comparing X-rays taken before death with those of the unidentified body taken after death.

Of course, just as no two individuals are alike, no two X-rays of the same bones of the same person are ever exactly alike because there is always some variation in the positioning of the subject, the X-ray technique, and the processing of the film. The skeleton also undergoes some remodeling throughout life, so that a certain amount of variation in detail is to be expected in films of the same individual taken a few years apart. However, with experience, these technical and age variations can be taken into account so that, given a pair of reasonably good films of the same person, posed in the same way, a positive identification can nearly always be made even if the X-rays were made many years apart by different technicians using different equipment.

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In the following analysis we have applied this method in comparing the post mortem X-rays said to be those of President Kennedy with clinical films known to have been taken prior to his death.

### *Materials examined*

Both ante mortem and post mortem X-rays were examined were from the JFK assassination materials created by the U.S. National Archives in Washington, D.C.

The autopsy X-rays bear the case No. 21296 of the U.S. Naval Hospital in Bethesda, Md. They include front and side views of the skull as well as a series of overlapping views of the torso and upper legs. There are also several X-rays of three skull fragments reportedly found in the Presidential automobile after the assassination.

In addition to the autopsy X-rays, the Archives collection includes three sets of clinical X-rays of President Kennedy taken at various times prior to his death. Two of these sets were made by personal physicians who treated the then-Senator Kennedy for an upper respiratory illness in August 1960. The earliest, dated August 14, bears the case No. 202617 of Dr. Stephen White, 521 Park Avenue, New York. The second set was made 3 days later at the clinic of Drs. Groover, Christie, and Merritt, of 1835 I Street NW., Washington, D.C., and bears the case number 336042. Dr. White's series consists of a side view of the head and a routine chest plate. Those from the Groover, Christie, and Merritt Clinic, include side and front views of the skull. The third set of ante mortem X-rays were taken at the U.S. Naval Hospital in Bethesda on March 14, 1962, while President Kennedy was undergoing treatment for a back complaint. These X-rays consist of front and side views of the lower spine and pelvis. Hereafter these three sets of ante mortem X-rays will be referred to as the "White," "Groover," and "Navy" films, respectively.

We first compared the "Groover" and "White" ante mortem X-rays of the skull with the autopsy films.

In the front views, we found that the outlines of the frontal sinuses of the autopsy X-rays were virtually superimposable on those shown in the clinical X-rays. The sinuses, which are lobular air pockets inside the bone that forms the forehead, vary uniquely in size and shape from one person to another. This variability is seen particularly in the outlines of their upper margin which typically cast a set of scallop-like shadows on the X-ray. This scallop pattern is so individually distinctive that forensic anthropologists have termed them "sinus prints." For many years, law courts throughout the world have accepted the matching of ante mortem and post mortem X-rays of the sinuses as evidence for the positive identification of unknown bodies. In the present case, the similarity in shape of the sinus print patterns in the ante mortem and post mortem films is sufficient to establish that they are of the same person on the basis of this trait alone.

In addition to the sinus prints, several other strikingly similar anatomical features were observed in the front view X-rays. For example, the nasal septum—the thin wall of cartilage and bone that separates the nostrils—was deviated to the same side and to an identical degree in ante mortem and post mortem films. Also the outlines of the bony rims of the orbits of the eyes were nearly identical. The very slight variations observed in these three features—sinus pattern, nasal



septum, and orbital margins—are the result of minor differences in the way the X-rays were taken.

The profile views of the skull in the White and Groover films were next compared to the autopsy X-rays. Again, a number of almost identical anatomical features were observed in the ante mortem and post mortem films. For example, the outlines of the *sella turcica* (the saddleshaped depression in the base of the skull), the complex patterns of the cranial sutures (the joints uniting the bones of the skull), and location and arrangement of the vascular grooves (the shallow depressions on the inner surface of the skull which mark the course of blood vessels), were the same. There was also nearly exact duplication of the honeycomb-like air cells of the mastoid bone.

The chest X-ray taken by Dr. White in 1960, was next compared to those of the upper torso taken at autopsy. Again, a number of identical features were noted in both sets of films. Among these were the outlines of the dorsal spines of the thoracic vertebrae. (These spines are the bony projections that are visible just under the skin along the center of the back.) In X-rays these spines project a vertical series of small shadows of varying sizes and shape that, like the architectural features of the skull discussed above, are virtually unique in each individual. In shape these shadows may range from almost perfect circles to irregular trapezoids. They vary not only from one individual to the next, but from one vertebra to another in the same individual so that the series of a dozen or so of these spines usually visible in a standard chest film, form a combination of shapes distinctive for each individual. Allowing for slight distortions due to position and technique, this series of spines can be considered identical in the ante-mortem and postmortem films.

In addition to the similar pattern of dorsal vertebrae spines, a number of other features common to both sets of films were observed. For example, the size and shape of the medial ends of the clavícula (collar bones) were identical, as was the pattern of ossification of the costochondral junctions of the first ribs. Numerous details in the form and trabecular structure of the ribs could also be matched from one set of films to the other, particularly in the left eighth and ninth ribs which were especially well-defined in both films.

The autopsy radiographs of the lower torso, including the pelvis and upper legs, could be compared to the ante mortem "Navy" films taken in 1962. These also show an impressive number of osseous details in common. Of particular interest was the right transverse process of the fifth lumbar vertebra. In both sets of films it was displaced upward in a manner suggestive of a congenital malformation or an old, un-united fracture.

To summarize, the skull and torso radiographs taken at autopsy match the available ante mortem films of the late President in such a wealth of intricate morphological detail that there can be no reasonable doubt but that they are indeed X-rays of John F. Kennedy and no other person.

#### AUTHENTICATION OF AUTOPSY PHOTOGRAPHS

##### *The issue*

Among the JFK assassination materials in the National Archives is a series of negatives and prints of photographs taken during autopsy. The deficiencies of these photographs as scientific documentation of a

forensic autopsy have been described elsewhere (Wilbur, 1968). Here it is sufficient to note that:

1. They are generally of rather poor photographic quality.
2. Some, particularly closeups, were taken in such a manner that it is nearly impossible to anatomically orient the direction of view.
3. In many, scalar references are entirely lacking, or when present, were positioned in such a manner to make it difficult or impossible to obtain accurate measurements of critical features (such as the wound in the upper back) from anatomical landmarks.
4. None of the photographs contain information identifying the victim; such as his name, the autopsy case number, the date and place of the examination.

In the main, these shortcomings bespeak of haste, inexperience and unfamiliarity with the understandably rigorous standards generally expected in photographs to be used as scientific evidence. In fact, under ordinary circumstances, the defense could raise some reasonable and, perhaps, sustainable objections to an attempt to introduce such poorly made and documented photographs as evidence in a murder trial. Furthermore, even the prosecution might have second thoughts about using certain of these photographs since they are more confusing than informative. Unfortunately, however, they are the only photographic record of the autopsy.

Not all the critics of the Warren Commission have been content to point out the obvious deficiencies of the autopsy photographs as scientific evidence. Some have questioned their very authenticity. These theorists suggest that the body shown in at least some of the photographs is not President Kennedy, but another decedent deliberately mutilated to simulate a pattern of wounds supportive of the Warren Commission's interpretation of their nature and significance. As outlandish as such a macabre proposition might appear, it is one that, had the case gone to trial, might have been effectively raised by an astute defense anxious to block the introduction of the photographs as evidence. In any event, the onus of establishing the authenticity of these photographs would have rested with the prosecution.

With the above considerations in mind, HSCA requested the anthropology consultants to examine the questions surrounding the authenticity of the JFK autopsy photographs. It should be emphasized that our inquiry was limited to determining the identification of the victim shown in the photographs. Other aspects of authentication concerning the possibility of technical alterations of the negatives and prints fall within the purview of other photographic experts. Also, we did not concern ourselves with the description and location of the wounds or of their nature and significance, since this was clearly the responsibility of the forensic pathology consultants.

#### MATERIALS EXAMINED

##### *Post mortem*

According to inventories (Humes et al., 1966, Carnes et al., 1968) of the JFK autopsy materials in the National Archives, the collection includes a total of 52 exposed negatives. These may be divided into two series: (1) 25 4 by 5 inch black and white, and (2) 27 4 by 5 inch color negatives. The entire series is numbered sequentially beginning



with the black-and-white series: Black and white; No. 1 to No. 25; color; No. 26 to No. 52.

Examination of prints of the total series revealed that most of the black-and-white negatives are virtually duplicates, in subject and view, to corresponding negatives in the color series. Therefore, our detailed analysis was limited to an examination of the latter. These items were in the form of 8 by 10-inch enhanced prints especially prepared for HSCA by Kodak Laboratories. Each print was identified by its original negative number. The entire series is described by subject in table I.

### *Ante mortem*

In order to compare the facial features of the autopsy subject with John F. Kennedy, a number of ante mortem photographs of President Kennedy were examined. These were also furnished by the National Archives. Two of these (National Archives Accession Nos. 79-AR-6378G and 79-AR-8008K) were selected for a more detailed comparison since they show a full profile of the subject with his mouth slightly open, and in pose and camera angle, correspond almost exactly with the full profile view of autopsy photograph No. 29.

### *Analysis*

To examine the autopsy photographs from the standpoint of identification of the victim we have considered two hypotheses:

1. That the subject shown in the photographs was not John F. Kennedy, but an unknown victim with a strong resemblance to the assassinated President.
2. That the victim in the photographs, in which the facial features are clearly visible, is indeed John F. Kennedy, but the body in which the face is not shown (particularly photographs No. 32 thru No. 37 which document the location of the critical wounds of the back and head) is that of another, unknown, individual.

In order to test the first hypothesis, it was necessary to compare the facial features of the victim in the autopsy photographs with antemortem photographs of President Kennedy. This comparison was made on the basis of both metric and morphological features.

In making this comparison, it was first noted that there were no gross inconsistencies between the autopsy victim and general physical characteristics of John F. Kennedy. The victim is a well-nourished, dark-haired, middle-aged, white male who appears to be of northern European ethnic stock.

Our metric analysis was based on a comparison of autopsy photograph No. 29 with the two ante mortem photographs (79-AR-6378G and 79-AR-8008K) selected from the National Archives series. The exact date of the ante mortem photographs was not determined, but both were made during the Kennedy Presidency and, therefore, do not antedate the autopsy photograph by more than 3 years. All three photographs show the subject in nearly perfect facial profile; Autopsy No. 29 and 79-AR-8008K are left profile and 79-AR-6378G is a right profile photograph.

A series of 11 facial measurements were taken on each photograph. These measurements are defined in table II. Measurements were recorded to the nearest 1 mm and made from 8 by 10-inch prints.



Three sets of measurements were made on each photograph, and the means were used to calculate the 10 indices given in table III. The arrangement of President Kennedy's hair made it impossible to take Physiognomic Face Height (No. 1) in photographs 79-AR-6378G; otherwise, all the 11 measurements could be taken on each photograph.

As shown in table III, the index values of the autopsy photograph and the two ante mortem photographs correspond very closely. For further comparison, the mean of the ante mortem indices was compared with the post mortem values (represented by a single value in indices 1, 4, and 7 which as based on measurement No. 1 that could not be taken on 79-AR-6378G). The deviation between the ante mortem and post mortem means range from 0.3 to 4 and the average deviation is 2.82 (table III). This small deviation can be accounted for by a combination of several factors such as the fact that in the autopsy the subject is supine while he is standing erect in the ante mortem photographs, and gravitational effects would cause some alteration of the facial features. The facial measurements would also be influenced by post mortem alterations and the effects of the massive cranial trauma. In short, the metric similarities, as expressed by facial indices are insignificant.

In addition to the strong metric similarities between autopsy photograph No. 29 and the two ante mortem photographs, a number of identical morphological features can be observed. Our examination of morphological similarities was not limited to the three photographs from which the measurements were taken, but included comparisons between the other autopsy photographs which show the victim's face (Nos. 26, 27, 28, 29, 30, 31, 40, and 41) and a series of 43 close-up photographs of President Kennedy selected from National Archives files to show his head and face from a variety of angles. In these comparisons, no inconsistencies in the morphological configuration of the eyes, nose, mouth, ears, or other facial features were observed and, on the contrary, a number of identical features were apparent. These include rather distinctive traits such as the downward convexity of the nasal septum and an angular and elevated nasal tip (the latter, by the way, a trait observable in other members of the Kennedy family). Among similarities noted in the ears are a strong antihelix, small, "tucked" tragus, narrow intertragic notch and attached lobes. The lower margin of the helix is strongly concave at its junction with the lobe, giving the latter a rather attenuated appearance. Patterns of facial lines and wrinkles were similar where they could be visualized in autopsy photographs. A partial list of morphological similarities between the autopsy subject and President Kennedy are shown in table IV. While they are simply listed in the table, each has a distinctiveness about it that impressed the examining anthropologists, both of whom have examined similar traits in a large number of human faces. Each of these traits, of course, can be separately observed in the general population. However, the probability of their occurring together in a single person is small. Their occurrence in two individuals with near-identical facial proportions, as expressed by the indices, is extremely remote.

On the basis of the foregoing, we conclude that the individual shown

in the autopsy photographs which show the victim's face is beyond reasonable doubt, President John F. Kennedy.

If it is accepted that the autopsy photographs showing the victim's face are those of John F. Kennedy, it then is necessary to examine the second hypothesis—namely that the remaining autopsy photographs are those of another person.

Examination of table I shows that the entire series of 27 autopsy photographs can be grouped as follows:

Groups :	Negative Nos.
1. Left lateral views_____	29, 30, 31
2. Right lateral views_____	26, 27, 28, 40, 41
3. Superior views_____	38, 39, 42, 43
4. Posterior views_____	32, 33, 34, 35, 36, 37
5. Cranial cavity_____	44, 45
6. Brain _____	46, 47, 48, 49, 50, 51, 52

The photographs within each of the groups vary only slightly in camera angle, lens-subject distance, subject position, lighting and exposure. There is also sufficient commonality in morphological features and other details to leave no doubt but what they are of the same subject. Since we have concluded that photographs in groups 1 and 2 (showing the face) are those of President Kennedy, we can compare these with features observed in the other photographs.

From the standpoint of pathological interpretation, the least informative photographs are those of group 3, which provide a superior view of the head and shoulders. This is because the scalp has neither been shaved or reflected from the cranium, procedures which would possibly have shown some of the crucial details of the cranial trauma. In these photographs, a portion of the victim's forehead and nose are shown from above. The configuration of these facial features are consistent with the nose and upper forehead contours of President Kennedy as surmised from the ante mortem photographs taken from more conventional angles. Also, certain random features such as blood-stains and an apparent post mortem, abrasion on the right shoulder (described in more detail below), which can be seen in the photographs of group 2, can be observed in this set of photographs. We are therefore of the opinion that these photographs are of the same person as shown in groups 1 and 2 of the autopsy photographs—namely, John F. Kennedy.

The most critical set of photographs from the standpoint of identification are those of group 4 that show the head and upper back of the victim from behind. To take these photographs, the victim was apparently raised to a semi-upright position and held there while the pictures were taken from the head of the autopsy table. The purpose of these photographs was to document the scalp and upper back wounds, the exact location of which has been a matter of considerable controversy. In these photographs, the only facial features visible are the back of the ears.

In comparing these photographs with those taken in group 2, which show the right side of the head and face, several features common to both were noted. These include two dried blood stains on the upper right shoulder approximately 16 centimeters lateral to the midline of the back. Approximately 7 centimeters medial to these are a series of 3 narrow parallel marks approximately 3 centimeters in length,



which appear to be slight skin abrasions. These marks and stains are situated several centimeters lateral to the back wound and do not appear to be directly associated with it. It is possible that they were made in the course of the handling and lifting of the body.

There is also a 3- by 5-centimeter area of discoloration at the base of the neck in the right area which apparently represents either a slight contusion or some post mortem lividity. All of these features are very irregular in shape and would thus be very difficult if not impossible to duplicate. Such minor and random details are also the kind of characteristics that would likely be overlooked in any attempted hoax. Likewise, the hair, which is in disarray and matted with blood and body fluids, presents a complex of irregularly arranged strands and locks. Yet, allowing for the different angles of view, these features appear to be identical in size, location and shape in both the posterior (group 4) photographs and those of the right lateral photographs of group 1, which can be identified as being of President Kennedy.

In addition to the above rather transient feature, others of a more permanent nature were noted. These were the network of transverse wrinkles extending across the back and side of the neck. Such lines develop in most individuals by middle age, but their exact arrangement forms a pattern that is virtually unique to the individual. Examination of these in the back photographs of group 4 shows that they are identical in pattern and development (again making allowance for view) as those seen on the lateral side of the neck in the group 1 photographs. In short, the profusion of minute and common detail lend us to conclude that the individual shown in both sets of photographs is the same.

The photographs of group 5, which show the cranial cavity with the brain removed, are somewhat more difficult to evaluate. One feature of interest is the outline of the fractured margin of the frontal bone which is partially visible in the foreground of these photographs. A deep V-shaped irregularity in this margin is also visible in photographs of group 1 in which the scalp is partially reflected to expose the underlying bone. The anterior margin of the cranial defects also corresponds in shape to the fractures observed in the cranial X-rays.

From the standpoint of positive identification, the most problematical group of autopsy X-rays are those of group 6 which show the isolated brain. Here we could find no anatomical features that would associate this brain with the remaining autopsy photographs. However, the trauma to the brain, effecting primarily the superior aspect of the frontal lobes is certainly consistent with the pattern of cranial trauma observed in the autopsy photographs and X-rays.

#### CONCLUSION

Based on our examination of the autopsy X-rays and photographs and comparison of these with known ante mortem X-rays and photographs of John F. Kennedy, we conclude as follows:

1. The individual shown in the autopsy X-rays is John F. Kennedy.
2. The individual shown in the autopsy photographs is John F. Kennedy.



3. The brain shown in autopsy photographs Nos. 46 to 52 cannot be positively identified as that of John F. Kennedy. However, this brain displays trauma consistent to the known pattern of injury sustained by President Kennedy and, in the absence of any positive evidence to the contrary, there is no reason to believe that it is not the brain of the late President.

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- (3) Carnes, W. H., R. S. Fisher, R. H. Morgan, and A. Moritz 1968. "Panel review of photographs, X-ray films, documents and other evidence pertaining to the fatal wounding of President John F. Kennedy on Nov. 22, 1963, in Dallas, Tex." Washington, D.C.: National Archives.

TABLE I.—*Description of autopsy photographs examined in authentication study*

Number:	
26, head, right lateral.....	Superio-lateral view of head in quarter profile. Includes anterior neck wound, upper chest and shoulders.
27, head, right lateral.....	
28, head right lateral.....	
29, head left lateral.....	Profile view. Includes anterior neck wound. No. 30 over-exposed.
30, head, left lateral.....	
31, head, left lateral.....	
32, head, superior.....	Superior view of head and shoulders.
33, head, superior.....	
34, head superior.....	
35, head, superior.....	
36, head, superior.....	
37, head, superior.....	
38, upper torso, posterior.....	Shows shoulder wound.
39, upper torso, posterior.....	
40, head, right lateral.....	Inferio-lateral view of head in quarter profile. Includes anterior neck wound.
41, head, right lateral.....	
42, head, posterior.....	Close-up of occipito-partial area showing scalp wound.
43, head, posterior.....	
44, cranial cavity.....	Anterio-superior views of cranial cavity. Brain removed.
45, cranial cavity.....	
46, brain interior.....	Removed from cranial cavity.
47, brain, inferior.....	
48, brain, inferior.....	
49, brain, inferior.....	
50, brain, superior.....	
51, brain, superior.....	
52, brain, superior.....	

TABLE II.—*Measurements used to derive indices for comparison of JFK ante mortem photographs with autopsy photograph No. 29*

1. *Physiognomic face height*.—Distance from the midpoint of the hairline to the lowest point on the chin (trichion to menton).
2. *Forehead height*.—Distance from the midpoint of the hairline to the most anterior point on the lower forehead just above the nasal root depression (trichion to glabella).
3. *Nose length*.—Distance from the deepest point of the nasal root depression to the junction point between the nasal septum and the upper lip (subnasion to subnasale).
4. *Total face height*.—Distance between the most anterior point on the lower

forehead just above the nasal root depression and the lowest point on the chin (glabella to menton).

5. *Ear length*.—Distance between the uppermost point on the helix of the ear and the lowermost point on the earlobe (superaurale to subaurale).

6. *Lobe length*.—Distance between the lowest point in the intertragic notch and the lowest point of the earlobe (intertragon to subaurale).

7. *Chin height*.—Distance from the point of contact between the upper and lower lip and the lowest point on the chin (stomion to menton).

8. *Chin eminence height*.—Distance from the point of deepest depression between the lower lip and chin and the lowest point on the chin (supramentale to menton).

9. *Nasal projection*.—Distance from the most anterior point on the nasal tip to the junction point between the nasal septum and the upper lip (pronasale to subnasale).

10. *Nasal elevation*.—Distance from the most anterior point on the tip of the nose to the posterior most point on the junction line between nasal alae and the cheek (pronasale to postalare).

11. *Total facial depth*.—Distance between the most anterior point on the nasal tip and the posterior most point on the posterior margin of the helix of the ear (pronasale to postaurale).

TABLE III.—*Comparison of facial index values of ante mortem photographs of President John F. Kennedy (79-AR-6378G, 79-AR-8008K) with left profile photograph (No. 29) of autopsy subject*

Mean deviation=2.82

Index <sup>1</sup> (M/M x 100)	Antemortem			Post-mortem No. 29	$\Delta$ <sup>2</sup>
	79-AR- 6378G	79-AR- 8008K	Mean		
1. 2/1 x 100.....		27.0	27.0	30.7	3.7
2. 3/4 x 100.....	26.4	35.1	35.8	33.1	2.7
3. 8/4 x 100.....	21.4	21.1	21.2	18.1	3.1
4. 7/1 x 100.....		28.4	28.4	25.6	2.8
5. 7/4 x 100.....	37.1	36.8	37.0	33.8	3.2
6. 6/5 x 100.....	29.4	33.9	31.6	33.9	2.3
7. 5/1 x 100.....		41.2	41.2	37.5	3.7
8. 9/3 x 100.....	47.1	45.0	46.0	50.0	4.0
9. 10/3 x 100.....	60.8	61.5	61.2	63.6	2.4
10. 5/11 x 100.....	49.7	45.9	47.8	47.5	.3

<sup>1</sup> Numbers refer to measurements defined in table II.

<sup>2</sup> Absolute differences between mean of ante mortem index and post mortem index.

TABLE IV.—*Morphological similarities in both the ante mortem and post mortem Kennedy photographs*

Convex angle of nasal septum.  
Lower third of nose convexity.  
Nasal tip area elevated.  
Attached ear lobe.  
Strong ear antihelix.  
"Tucked" ear tragus.  
Distinctive lip profile.  
Identical facial crease lines.  
Similar neck crease lines.

## (181) ADDENDUM B

### REPORT TO THE SELECT COMMITTEE ON ASSASSINATIONS, U.S. HOUSE OF REPRESENTATIVES

#### IDENTIFICATION OF THE SKULL X-RAY FILMS TAKEN DURING THE AUTOPSY OF PRESIDENT JOHN F. KENNEDY

(By Lowell J. Levine, D.D.S., Consultant for the Select Committee  
on Assassinations, U.S. House of Representatives, Sept. 7, 1978)

#### AUTHENTICATION OF AUTOPSY FILMS 1, 2, AND 3

##### BASIS FOR DENTAL IDENTIFICATION

The science of dental identification is based upon the fact that characteristics associated with the dentition and the hard and soft tissue structures of the oral cavity occur in astronomical numbers of combinations.

Typically, the adult dentition contains 16 teeth in each jaw; 4 incisors, 2 canines, 4 premolars, and 6 molars. Each tooth has characteristics such as morphology, root configuration, root canal shapes, anomalies, pathology, and the like which are unique and individual to that particular tooth. Similarly, the supporting structures of the oral cavity have unique and individual characteristics.

Teeth are often attached by carious lesions (decay) and other processes which cause unique and individual characteristics.

There are five surfaces on each tooth which may be attacked by dental caries and restored by the dentist. On posterior teeth (premolars and molars), mesial and distal (toward and away from the midline), occlusal (the grinding surface), buccal (towards the cheek), and lingual (towards the tongue). On anterior teeth (incisors and canines) mesial and distal, facial or labial (towards the face or lips), lingual, and incisal (cutting surface). These surfaces may be attacked by dental caries singly or in combination and restored by the dentist in single- or multiple-surface restorations. Different surfaces on the same tooth may be restored with various filling, insulating, and lining materials. Different sized and shaped dental burs (drills) are used to remove the dental caries, and prepare the tooth to receive the filling material.

The dentist uses various materials to repair the effects of dental caries. Metals such as gold in various forms and silver amalgam are commonly used. Porcelains and acrylics are used and various cements are used as temporary restorations, insulating materials, and sealers.

It should be abundantly clear that the possible combinations which may occur because of such factors as presence or absence of particular teeth, surfaces of each tooth free of caries or decayed, surfaces of each tooth present restored with various types of dental materials, sizes and shapes of cavity preparations is limitless.



Almost all dental evidence is useful for identification purposes. Dental evidence could include the written records of examinations and treatments. Models of the mouth, teeth, and jaws used for diagnosis and treatment planning or the actual fabrication of prosthetic appliances. The prosthetic appliances themselves. Photographs and X-ray films taken incident to diagnosis and/or treatment.

X-ray films are excellent evidence for identification purposes. The films will graphically exhibit characteristics such as presence or absence of teeth, rotations of teeth, level of eruption of teeth, tipping of teeth, and the relation of these teeth to each other.

The films will show the morphology of teeth, roots, and root canals as well as the presence of caries, root canal therapy, pathology such as retained roots and cysts, unerupted teeth, anomalies, wear, and breakage among other things.

We may examine the shapes of fillings, extent of caries involvement and removal, cement materials present, and density of filling materials. Hard tissue patterns, pathology, and landmarks are also graphically represented.

Even when extensive dental treatment, performed subsequent to the date of the X-ray films, has considerably altered the visual appearance of the teeth, the underlying hard tissue characteristics remain quite distinctive.

#### DENTAL IDENTIFICATION PROCESS

The dental identification process will include a comparison by the forensic odontologist of the unique and individual characteristics exhibited by the evidence at hand with previously existing records containing evidence of those same characteristics. The forensic odontologist will use his training, experience, skill, and expertise to form an opinion as to whether his comparison is positive. He will render that opinion in a report which will also contain the basis for that opinion.

The early use of dental identification in the United States can be documented in two historically significant cases which both occurred in President Kennedy's home State of Massachusetts.\*

Paul Revere, noted for his famous ride and as a silversmith, also practiced dentistry. Gen. Joseph Warren, a Revolutionary War hero killed at the Battle of Bunker Hill, had been a patient of Revere. Originally buried by the British, his remains were subsequently identified by Revere some 10 months later when Revere recognized a prosthetic appliance he had made for General Warren.

In 1850 the Webster-Parkman case shocked Boston. Dr. John White Webster, professor of chemistry and mineralogy at Harvard Medical School was convicted of murdering Dr. George Parkman, professor of anatomy at Harvard Medical School. In his first recorded instance of dental identification in the courtroom, Dr. Nathan Cooley Keep, subsequently first dean of Harvard Dental School, identified a few fragments of lower jaw and an intact porcelain bridge which fitted the cast Dr. Keep had preserved from recent dental care of the

---

\*Historical references: Sognaes, Reider F., "Talking Teeth", *American Scientist*, vol. 64, p. 369 Luntz & Luntz, "Handbook for Dental Identification," J. B. Lippincott, Philadelphia, 1973, pp. 1-15.

missing Dr. Parkman. An expert witness for the defense was William Morton, the young Boston dentist of ether anesthesia fame.

#### EVIDENCE USED IN THE DENTAL IDENTIFICATION PROCESS

The evidence to be used for the comparisons was in the custody of the National Archives of the United States at the time I examined it. There was a "descriptive list" of the materials which was apparently made when the National Archives received them from the Kennedy Library.

"Descriptive list" (items I personally used for comparisons):

1. *Manila envelope—business letter size.*—Addressed to Capt. J. W. Pepper, D.C., USN, containing two dental films, loose JFK July 12, 1962.
2. *Manila envelope—business letter size.*—marked JFK April 4, 1962, containing two dental films, loose.
3. *Manila envelope—about 5 by 6 inches.*—
  - a. One mounted dental film dated March 11, 1961.
  - b. Two mounted dental films dated March 11, 1961.
  - c. Five mounted dental films dated January 18, 1961.
  - d. One mounted dental film dated March 8, 1962.
6. *Manila Sleeve, about 10 inches by 12 inches.*—JFK sinus films, August 17, 1960, containing five films.
7. *Manila envelope (sic), about 10 inches by 12 inches.*—JFK sinus films, August 14, 1960, containing four films.

Description of 1, 2, 3, 6, 7:\*

1. *Two dental films loose.*—Both are left mandibular periapical\*\* type films. The root apices (ends of the roots) do not appear on the films. One film is taken slightly anterior to the other. The anterior film includes a portion of the lower left canine, both lower left premolars, the lower left first molar, and a portion of the lower left second molar. (Universal Nos. 22, 21, 20, 19, 18.)

The posterior film includes a portion of the lower left first premolar, the lower left second premolar, the lower left first molar, and a portion of the lower left second molar. (Universal Nos. 21, 20, 19, 18.)

The following surfaces are interpreted to be restored: first premolar (No. 21), distal occlusal; second premolar (No. 20), mesial occlusal distal; first molar (No. 19), mesial occlusal distal; second molar (No. 18), mesial occlusal.

The restorations are interpreted as cast metal restorations. A less radio opaque material pulpal (toward the "nerve") to the restorations is interpreted as dental cement. The lower left first molar (No. 19) appears to have a portion of a previous metallic restoration on the pulpal floor.

2. *Two dental films loose.*—Both are left mandibular periapical type films. One film includes the root apices, the other does not. Both films

\*The teeth will be described by name and by the universal numbering system. In this system the maxillary (upper) right third molar is No. 1, the maxillary left third molar No. 16, the mandibular (lower) left third molar No. 17, the mandibular right third molar No. 32.

\*\*This type film usually is of the crown and root portions of a tooth or teeth in a segment of one jaw.

include a portion of the lower left canine, the two lower left premolars, the lower left first molar, and a portion of the lower left second molar. (Universal Nos. 22, 21, 20, 19, 18.)

The following surfaces are interpreted to be restored: first premolar (No. 21), distal occlusal; second premolar (No. 20), mesial occlusal distal; first molar (No. 19), mesial occlusal distal; second molar (No. 18), mesial occlusal.

The restorations are interpreted as cast metal restorations. A less radio opaque material pulpal to the restoration is interpreted as dental cement. The lower left first molar (No. 19) appears to have a portion of a previous metallic restoration on the pulpal floor.

3a. *One mounted dental film dated March 11, 1961.*—A film mount marked, "Kennedy JF March 11, 1961," contains a left bite wing\* type film. It includes a portion of the upper left first premolar, lower left first premolar, upper and lower second premolars, first and second molars. (Universal Nos. 12, 13, 14, 15, 21, 20, 19, 18.)

The following surfaces are interpreted to be restored:

Upper: First premolar (No. 12), mesial occlusal distal; second premolar (No. 13), mesial occlusal distal; first molar (No. 14), mesial occlusal distal; second molar (No. 15), mesial occlusal distal.

Lower: First premolar (No. 21), distal occlusal; second premolar (No. 20), mesial occlusal distal; first molar (No. 19), mesial occlusal distal; second molar (No. 18), mesial occlusal.

The restorations are interpreted as cast metal on all surfaces except for those of the two upper premolars. The restored surfaces on these two teeth are metallic and may be either cast metal or silver amalgam. There is dental cement pulpally on all teeth except the upper and lower first premolars. There appears to be a portion of a previous metallic restoration on the pulpal floor of the lower left first molar.

3b. *Two mounted dental films dated March 11, 1961.*—A film mount marked, "Kennedy John F 11 March 61" contains two maxillary left periapical type films. These include a portion of the upper first premolar, upper second premolar, upper first molar, and upper second molar. (Universal Nos. 12, 13, 14, 15.)

The following surfaces are interpreted to be restored: First premolar (12), distal occlusal (mesial portion of tooth is not shown on the film); second premolar (13), mesial occlusal distal; first molar (14), mesial occlusal distal (probably lingual); second molar (15), mesial occlusal distal.

All restorations are interpreted as being of metal with the molars probably cast metal. There is cement visible under all restorations with the exception of the first premolar.

3c. *Five mounted dental films dated January 18, 1961.*—A film mount marked, "Kennedy, Pres John F January 18, 1961". The mount bears a stamp, "Robert D. Morris, D.D.S., 140 East 54th St., New York, 22, N.Y."\*\* The mount contains five X-ray films. There are two right bite

\*This type film is usually of the crown portions of opposing teeth of a segment or an entire side.

\*\*Dr. Morris confirmed the fact that he treated President Kennedy on Jan. 18, 1961 in a telephone conversation which occurred on June 7, 1978. This appointment was 2 days prior to his inauguration. He had a routine "check up" which included X-rays and "cleaning".



wing type films, two left bite wing type films, and one maxillary left periapical type film.

One right bite wing film is taken anterior to the other. The more anterior film contains a portion of the upper and a portion of the lower canine, the upper and lower first and second premolars, the upper and lower first molars, a portion of the upper and lower second molars. The more posterior film contains a portion of the upper and a portion of the lower second premolars, the upper and lower first and second molars.

The following surfaces are interpreted to be restored:

Upper right: Canine (6), distal; first premolar (5), occlusal; second premolar (4), mesial occlusal distal; first molar (3), mesial occlusal distal; second molar (2), mesial occlusal.

Lower right: First premolar (28), occlusal, occlusal; second premolar (29), distal occlusal; first molar (30), mesial occlusal distal; second molar (31), mesial occlusal.

The upper right canine is interpreted as having a cement restoration. All other restorations are metal. The first premolars appear to have silver amalgam restorations, all others appear to be cast metal. There appears to be cement pulpal to all restorations except those of the first premolars.

One left bite wing film is taken anterior to the other. Both films include the upper and lower first premolars, second premolars, first molars and second molars. The more anterior film includes a portion of the upper and lower second molars, the more posterior film, a small portion of the upper and lower first premolars.

The following surfaces are interpreted to be restored:

Upper left: First premolar (12), distal occlusal; second premolar (13), mesial occlusal distal.

Upper left: First molar (14), mesial occlusal distal; second molar (15), mesial occlusal distal.

Lower left: First premolar (21), distal occlusal; second premolar (20), mesial occlusal distal; first molar (19), mesial occlusal distal; second molar (18), mesial occlusal.

The restorations are interpreted as cast metal on all surfaces with the exception of the two upper premolars. The restored surfaces on these two teeth are metallic and may be either cast metal or silver amalgam. There is dental cement pulpally on all teeth except the upper and lower first premolars. There appears to be a portion of a previous metallic restoration on the pulpal floor of the lower first molar.

The maxillary left periapical film includes a portion of the upper first premolar, second premolar, first and second molars.

The following surfaces are interpreted to be restored:

Upper left: First premolar (12), distal occlusal; second premolar (13), mesial occlusal distal; first molar (14), mesial occlusal distal (probably lingual); second molar (15), mesial occlusal.

The restored surfaces of the molars are interpreted as cast metal. The premolars may be either cast metal or silver amalgam. There appears to be cement under all restorations with the exception of the first premolar.

3d. *One mounted dental film dated March 8, 1962.*—A film mount marked, "JF Kennedy March 8, 1962" contains an upper left periapi-

cal-type film. The film concludes a portion of the upper left canine, first and second premolars, first molar, and a portion of the second molar.

The following surfaces are interpreted to be restored:

Upper left: First premolar (12), distal occlusal; second premolar (13), mesial occlusal distal; first molar (14), mesial occlusal distal; second molar (15), mesial occlusal (the distal portion of) No. 15 is not in the film.

All surfaces are restored in metal. The molars appear to be restored with cast metal the premolars with either cast metal or silver amalgam. Cement is apparent pulpally on all teeth but the first premolar.

6. *JFK sinus films, August 17, 1960, \* \* \* five films.*—There is a container marked, "5 sinus films"—J.F.K.

It is labeled: "Name Kennedy, Mr. John F., No. 336042; Remarks August 17, 1960.

Drs. Groover, Christie & Merritt  
1835 I Street NW.  
Washington 6, D.C."

The manila sleeve contains five X-ray films. One is a lateral skull film. Four are AP films taken at various angulations.

The configuration of the frontal sinuses can be clearly determined from the AP films.

The following dental restorations can be interpreted from the lateral skull film:

Upper left: First premolar (12), distal occlusal; second premolar (13), mesial occlusal distal; first molar (14), mesial occlusal distal; second molar (15), mesial occlusal distal.

Lower left: First molar (19), mesial occlusal distal; second molar (18), mesial occlusal.

Superimposition in the premolar area makes clear interpretation difficult. Overlapping makes clear interpretation difficult toward the anterior region.

These restorations all appear to be metallic. Cement can be clearly seen pulpal to the restorations in the molar area. There appears to be a portion of a previous metallic restoration pulpal to the restoration and cement liner on the lower left first molar (19).

7. *JFK Sinus Films, August 14, 1960, \* \* \* four films.*—There is a container marked, "#202617, 8-14-60, JFK, Dr. Stephen White, 'Sinus X-Rays'".

The envelope contains one lateral skull film and three AP-type films taken at various angulations.

The configuration of the frontal sinus can be clearly determined from the AP films.

The following dental restorations can be interpreted from the lateral skull film: Upper right second molar (2), occlusal portion of restoration; upper left second molar (15), distal portion of restoration; lower right first molar (30), mesial occlusal distal; lower right second molar (31), mesial occlusal.

There is considerable superimposition and overlap.

*Authenticity of 1, 2, 3a, 3b, 3c, 3d, 6, 7.*

The first task of the forensic odontologist is to form an opinion as to whether the films he will use for comparison with the films in ques-

tion are authentic. The 22 films described were received by the National Archives from the Kennedy Library. According to a source at the Kennedy Library, the films were found in the White House after the death of the President. They came to the Kennedy Library through a family member.\*

#### Dates of Films and Source:

August 14, 1960—later skull film; three AP skull films—Dr. Stephen White, No. 7.

August 17, 1960—lateral skull film, four AP skull films—Drs. Groover, Christie, & Merritt No. 6.

January 18, 1961—five dental films—Dr. Robert D. Morris—No. 3c two right bite wings, two left bite wings, one left maxillary periapical.

March 11, 1961—three dental films—Capt. J. W. Pepper, D.C., USN—No. 3a, 3b; one left bite wing, two left maxillary periapicals.

March 8, 1962—one dental film—Capt. J. W. Pepper, D.C., USN—No. 3d; one left maxillary periapical.

April 9, 1962—two dental films—Capt. J. W. Pepper, D.C., USN—No. 2; two left mandibular periapicals.

July 12, 1962—two dental films—Capt. J. W. Pepper, D.C., USN—No. 1; two left mandibular periapicals.

#### Films of the left side:

No. 1. Two films July 12, 1962—two mandibular periapicals.

No. 2. Two films April 9, 1962—two mandibular periapicals.

No. 3a. One film March 11, 1961—bite wing.

No. 3b. Two films March 11, 1961—two maxillary periapicals.

No. 3c. Three films January 18, 1961—two bite wings, one maxillary periapical.

No. 3d. One film March 8, 1962—maxillary periapical.

No. 6. One film August 17, 1960—lateral skull.

There are 12 films taken over a 23 month period by at least three different sources, Drs. Pepper, Morris, and White.

#### Films of the right side:

No. 3c. Two films Jan. 18, 1961—two bite wings.

No. 7. One film Aug. 14, 1960—lateral skull (also shows portion of left).

There are three films taken in a 5-month period by two different sources, Dr. Morris and Drs. Groover, Christie, and Merritt.

There are seven films useful for comparing frontal sinus configurations, No. 6 and No. 7 from two different sources, Dr. White and Drs. Groover, Christie, and Merritt.\*\*

#### *Opinion as to the authenticity of the films to be used for comparisons*

Dr. Robert D. Morris confirms the fact that he did expose X-ray films on President John F. Kennedy on Jan. 18, 1961. There are numerous unique and individual characteristics reproduced in the 15 films illustrating the dentition. The films were acquired from at least four different sources. Films taken in like areas may be easily

\* William Moss, chief archivist, Kennedy Library.

\*\*It is interesting to note that President Kennedy had numerous X-ray films of the left side taken in the period between Mar. 11, 1961 and July 12, 1962. One could speculate that he was suffering from some nonspecific dental pain of the left posterior area during that period.



compared with each other. It is my opinion that all films were taken on the same person, John F. Kennedy.

### *Autopsy films 1, 2, 3*

Description of films:

1. AP skull film.
2. Lateral skull film.
3. Lateral skull film.

Each film is marked, "21296" U.S. Naval Hospital, NNMHC, Bethesda, Md.

### *Description of areas of comparison of autopsy 1, 2, 3*

*Autopsy 1.*—The configuration of the frontal sinuses are quite distinctive. The right side is "heart" shaped, the left almost "rhomboid."

*Autopsy 2.*—There is considerable superimposition and overlap of the jaws, teeth, and restorations, however, the right side appears slightly superior. There is a radio-opaque rectangular-shaped object with three small and one large radiolucent circular areas in it extending from the second lower premolar considerably beyond the third molar area. It obliterates the roots of the molars and extends at an angle beyond the inferior border of the mandible. Because of the angulation at which this film was taken, this object is parallelogram shaped, the circular areas oval-shaped.

The configuration and juxtapositions of a number of the dental restorations are useful for comparison purposes. The two occlusal restorations can be clearly interpreted on the lower right first premolar (28) as can the occlusal portion of the distal occlusal restoration on the lower right second premolar (29). In the second molar area the two second molars are superimposed upon each other. The very distinctively shaped cement liner in the lower left second molar (18) is quite apparent. It is kidney-shaped with the concavity toward the pulpal floor. The deeper portion extends toward the distal. Immediately above the cement liner is the occlusal portion of the mesial occlusal restoration. The concave distal occlusal wall is apparent. The shallow portion of the distal occlusal wall of the mesial occlusal restoration in the lower right second molar (31) can be interpreted immediately above the convexity of the distal occlusal wall of the lower left second molar (18) restoration. The deeply rounded floor of the mesial portion of the mesial occlusal restoration on the lower left second molar (18) can be seen.

The distal portions of restorations on the upper second molars can be interpreted although considerably superimposed upon each other.

There are unquestionably ample unique and individual characteristics which can be interpreted for comparison purposes contained in this film.

*Autopsy 3.*—There is no superimposition of the maxillary left segment. Although there is slight overlap, the configuration and juxtapositions of the dental restorations in this segment can be readily interpreted. There is superimposition of the right maxillary molar area on the superior portion of the occlusal of the lower right second premolar (29) and lower right first molar (30). There is a radio-opaque rectangular object, apparently the same object as in autopsy 2, which obliterates almost entirely both lower left premolars, the roots of the

lower left first molar, and a portion of the roots of the lower left second molar. The lower left second molar appears free of distortions.

The characteristics of the restorations and existing lining materials can be readily interpreted on the following teeth: Upper left: First premolar (12); second premolar (13); first molar (14); second molar (15).

Upper right: First premolar (5); second premolar (4).

Lower left: First molar (19); second molar (180).

There are numerous unique and individual characteristics which can be interpreted for comparison purposes contained in this film.

### *Comparisons*

*Autopsy 1.*—The configurations and relationships of the frontal sinuses depicted in this film and in films contained in sinus 6 and sinus 7 are similar.

*Autopsy 2.*—The unique and individual characteristics described in this film can also be interpreted in films contained in: 1, 2, 3a, 3c, 6, and 7.

*Autopsy 3.*—The unique and individual characteristics described in this film can also be interpreted in films contained in: 1, 2, 3a, 3b, 3c, 3d, 6, and 7.

### *Conclusions*

It is my opinion that autopsy films 1, 2, and 3 are unquestionably of the skull of President John F. Kennedy. It is further my opinion that the unique and individual dental and hard tissue characteristics which may be interpreted from autopsy films 1, 2, and 3 could not be simulated.

LOWELL J. LEVINE, D.D.S.

### EXHIBITS

Comparison of dental X-rays are visually quite persuasive when presented to juries of lay persons as photographic "blowups". The forensic odontologist can easily demonstrate the characteristics and relationships he has interpreted to form his opinion.

Almost at the outset of my examination in consultations between Dr. Michael M. Baden, the committee staff, and myself, it was decided it would be very desirable to attempt to get permission to reproduce portions of X-ray films which were significant in forming my opinion.

The strongest reason for publishing facsimiles of the X-ray evidence is that they are so much more convincing than a narrative description of characteristics compared.

The committee staff obtained permission for me to photograph and reproduce portions of the films I felt were necessary to document the identification and authentication. Autopsy No. 1, was not photographed at that time because it was my understanding that my permission precluded reproducing areas which depicted injury pattern. The fact that documentation of autopsy No. 1, is not included in these exhibits should in no way be construed to imply that my opinion as to the authenticity of that film is anything less than a positive identification.

On November 15, 1977, I personally photographed the films at the National Archives. The exhibits were produced under my direction

by Walter Poppe, forensic photographer, office of the medical examiner, Nassau County, N.Y., while employed as a private consultant.

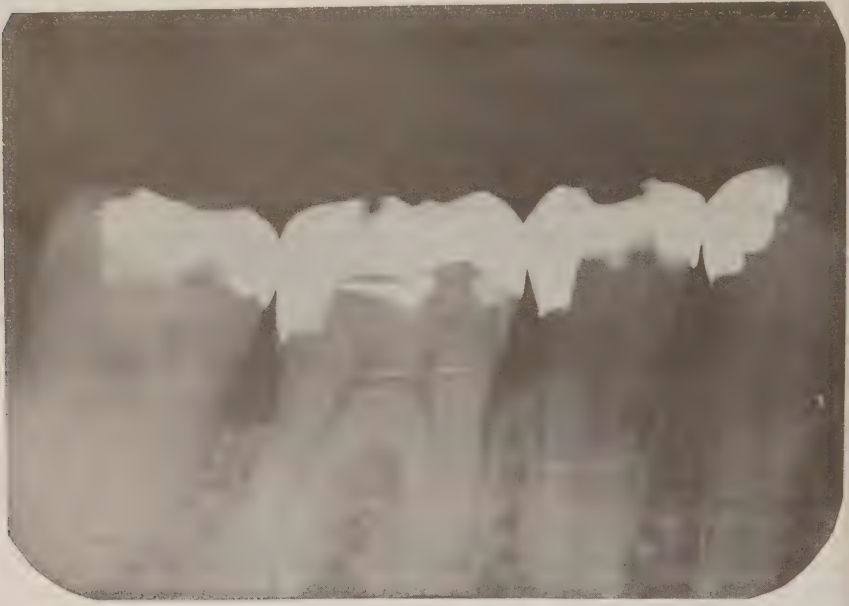
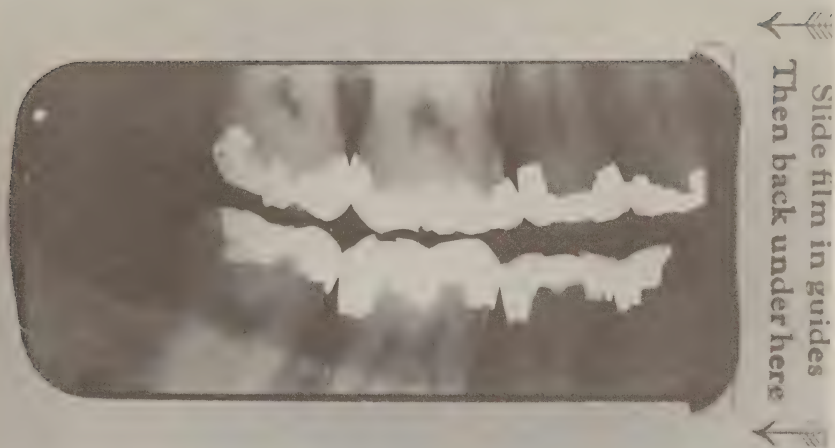


FIGURE 1.—Dental film (descriptive list 1) taken July 12, 1962. The more posterior of the two films described.



FIGURE 2.—Dental film (descriptive list 2) taken April 9, 1962. One of the two films described.





N CHICAGO U. S. A.

FIGURE 3.—Dental film (descriptive list 3a) taken Mar. 11, 1961.

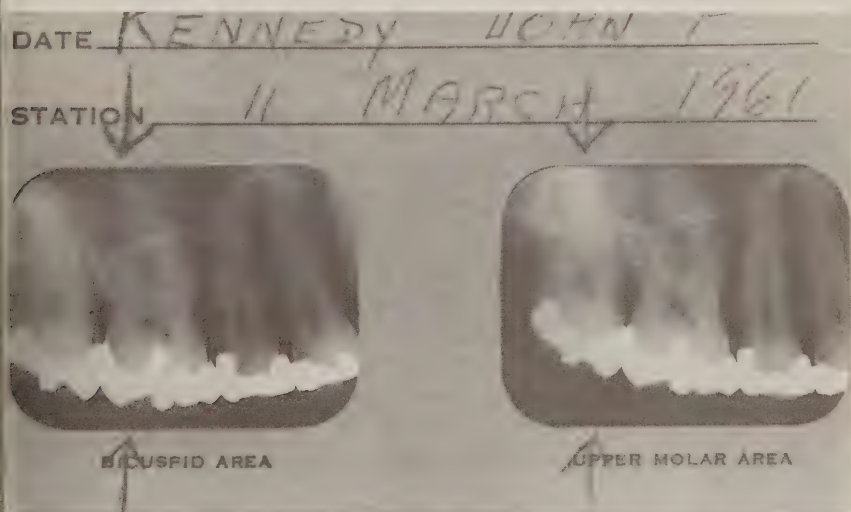


FIGURE 4.—Dental films (descriptive list 3b) taken Mar. 11, 1961.

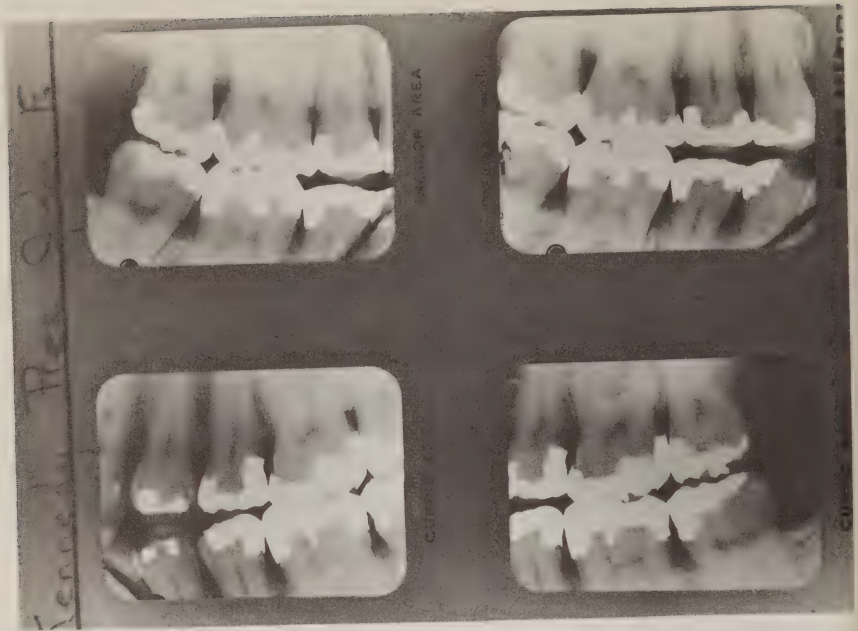


FIGURE 5.—Dental films (descriptive list 3c) taken Jan. 18, 1961. Four of the five films described.



FIGURE 6.—Dental film (descriptive list 3d) taken Mar. 8, 1962.



FIGURE 7.—Sinus film (descriptive list 6) taken Aug. 17, 1960. Dentition and supporting structures depicted in lateral skull film.





FIGURE 8.—Sinus film (descriptive list 6) taken Aug. 17, 1960. "Waters Position" type film.



FIGURE 9.—Sinus film (descriptive list 7) taken Aug. 14, 1960. Dentition and supporting structures depicted in lateral skull film.



FIGURE 10.—Autopsy 2. Dentition and supporting structures.



FIGURE 11.—Autopsy 3. Dentition and supporting structures.

\*(182) ADDENDUM C

WEST REDDING, CONN., *August 15, 1978.*

MS. JANE DOWNEY,  
*House Select Committee on Assassinations, U.S. House of Representatives, House  
 Office Building. Annex 2, Washington, D.C.*

DEAR JANE: Enclosed is a report on the authenticity of the color autopsy pictures.

With best regards,

FRANK SCOTT.

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\*Paragraphs (183) to (190) represent duplicated material.



## REPORT ON AUTOPSY COLOR PHOTOGRAPHS AUTHENTICITY

(By Frank Scott, August 15, 1978)

I have carefully analyzed the original color transparencies exposed in the camera used by the photographer during the autopsy of President Kennedy. The photographer took two or more pictures of each scene; for each scene he used a different exposure (different shutter speed or different lens f-number) for each of the two or more pictures; this is a common practice of photographers to enhance the probability that one of the pictures of a particular scene is exposed properly and also as insurance in the event any of the two or more pictures of a scene are lost due to camera or processing (developing) failures.\* The two or more pictures taken by the photographer of a particular scene in several instances were made with the camera in slightly (a few centimeters) different positions in space. For other scenes, the photographer made the two or more exposures from the same position in space, probably using a tripod on which the camera was mounted or using a specimen stand as was, apparently, the case for the pictures made of the brain specimen. The fact that two or more pictures of a particular scene were made from slightly different positions is very fortunate because the variation in camera position provides true stereophotography, somewhat analogous to the different positions of microphones in stereo recording of an orchestra. A pair of stereo pictures enables one to see the scene in three dimensions; stereo pictures add depth to the perception of the photographed scene in much the same way as a pair of human eyes, separated from one another in space, can perceive depth.

The stereo pairs of pictures provide a sound basis upon which to assess the authenticity of the photographs. The same is true of the non-stereo pairs, such as the brain pictures, but to somewhat lesser extent.

In the case of nonstereo pairs of pictures, the pictures can be superimposed on one another; the superimposition can be achieved physically (actually placing one transparency over or on another transparency) or by optical means (where the image of the transparencies are optically brought together in register). Careful examination of the superimposed pictures will reveal differences between the two pictures. In viewing stereo pairs of photographs, one eye views one picture and the other eye views the second picture; the eyes, coupled with the visual image processes of the brain, very readily reveal differences be-

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\* I was employed as a medical photographer at the M. D. Anderson Hospital and Tumor Research Institute while attending college; for the photography of patients, for autopsy photography, and for anatomical specimen photography it was a policy of the photography department to take three pictures of every scene photographed for the reasons cited above; after film processing the two poorest pictures were discarded.

tween the two pictures. When viewing a photographed scene using a stereo pair of photographs, differences in the scene between the two pictures tend to "pop out at you", that is, are easily noted. When viewing a photographed scene using a nonstereo pair of photographs, differences between the photographs are apparent but not as readily noted and thus require more careful examination.

To successfully avoid detection of picture alteration requires that each picture of a pair of pictures be altered identically, which is essentially impossible, particularly with a stereo pair since each picture of a stereo pair is a picture of the scene from a slightly, but directly comparable, point of view. Any nonidentical alteration of the pictures of a pair is readily noted when pairs are viewed stereoscopically or monoscopically. A clear demonstration of this is provided by one particular stereo pair: In one picture of the pair there are more droplets of blood on the towel directly beneath a clump of hairs of President Kennedy's head than there are in the other picture of the pair; when viewing this scene in stereo, it becomes very quickly and clearly apparent that the two pictures are not identical with specific respect to this blood-droplets detail; obviously, during the elapsed time between the two pictures, additional blood dripped from the hair onto the towel.

In a careful examination of the pictures made of each scene, and in searching for, and finding, candidate pictures for stereo pairs for use by medical experts for the select committee, I did not find any indication or evidence that any of the pictures were altered and, thus, I conclude that these pictures are authentic photographs. In forming this conclusion, I assume that the object photographed is, indeed, the body of President Kennedy.

Attachment.

#### TRANSPARENCY IDENTIFICATION NUMBERS

Among the autopsy transparencies, the following pairs provided stereoscopic viewing of the photographed scene:

43 JB and 42 JB  
 33 JB and 32 JB  
 44 JB and 45 JB  
 34 J7B and 37 J7B  
 26 J7B and 28 J7B

while the following pairs provided stereoscopic viewing but of poor stereo quality:

38 JB and 39 JB  
 41 J7B and 40 J7B

while the following pairs, or sets of three pictures, appeared to be identical to one another but did not provide stereoscopic viewing:

32 JB and 36 JB  
 37 JB and 35 J7B  
 29 J7B and 31 JB and 30 J7B  
 26 J7B and 27 J7B  
 47 JB and 46 JB and 48 JB  
 52 J7B and 51 JB and 50 JB

The numbers refer to those appearing on the envelopes or protective cellophane sleeves of the 4 by 5 inch positive transparencies as provided

to me by Archive Courier, Mr. Bill Grover, on March 2, 1978; these numbers may not be consistent with other references to these photographs during the past years since the transparencies may not have been stored consistently in their own, correct, envelope or sleeve; the "JB" or "J7B" portion of the notations or labels may not be correct since it is merely my interpretation of letters/numbers which were not clearly written and possibly misread by me.





# EVALUATION OF THE MEDICAL, PATHOLOGICAL AND RELATED EVIDENCE PERTAINING TO THE DEATH OF PRESIDENT JOHN F. KENNEDY

(BY THE FORENSIC PATHOLOGY PANEL)

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Werner V. Spitz, M.D., Medical Examiner, Detroit, Mich.

Cyril H. Wecht, M.D., J.D., Coroner, Allegheny County, Pittsburgh, Pa.

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## EVALUATION OF THE EVIDENCE

(191)\* Dr. Loquvam prepared the initial draft and conclusions of this report. Subsequently it was redrafted and edited by Dr. Weston at the Center of Forensic and Environmental Science, School of Medicine, University of New Mexico, Albuquerque, N. Mex.

(203) The charge addressed to the members of the Panel within the appointing letter of August 8, 1977 was as follows:

1. To determine whether there are fundamental conclusions within the field of forensic pathology on which all or most of the consultants can agree;
2. To write a report containing descriptions and interpretations of the medical evidence and detailed explanations supporting any conclusions;
3. To compile recommendations regarding those matters deemed to be outside the expertise of forensic pathologists; and
4. To conduct a detailed, objective critique of the professional manner in which the autopsy on President Kennedy was conducted.

(204) In accordance with the wishes of the committee, this report is divided into several parts, as follows:

- I. Procedures followed by the forensic pathology panel;
  - II. Recommendations for additional examinations, procedures and consultations by nonpathology disciplines;
  - III. Observations and conclusions derived from the examination of the available evidence, interviews, specifically requested ancillary procedures, and consultations;
  - IV. Critique of the earlier examination, with presentation of suggested procedures to be followed in performing an investigation and examination on the remains of a gunshot victim;
  - V. Suggested procedures to be followed in the event of subsequent assassinations of Federal officials;
  - VI. Dissenting view to the forensic pathology panel report, submitted by Cyril H. Wecht, M.D., J.D.
  - VII. Majority response to the dissent of Cyril H. Wecht, M.D., J.D.
  - VIII. Glossary of terms (those appearing in the glossary are denoted in the text by an asterisk (\*)).
- Various addenda and the footnotes follow part VIII.

### PART I: PROCEDURES FOLLOWED BY THE FORENSIC PATHOLOGY PANEL

(205) The larger subpanel, which had not previously reviewed the medical evidence, convened initially on Sept. 15, 1977, at the House Office Building, Annex II; on Sept. 16 and 17, 1977 at the National Archives; and on Sept. 18, 1977, at the House Office Building, Annex II. The material listed in addendum A to this report was made available to the subpanel at the initial meeting. The material listed in addendum B was made available the second and third days at the National Archives.

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\*Paragraphs (192) to (202) represent duplicated materials.

(206) The second subpanel convened initially on Sept. 22, 1977, at the House Office Building, Annex II; and on the next day, Sept. 23, 1977, at the National Archives; and, subsequently at the House Office Building, Annex II. The material listed in addendum A was made available to this subpanel at the initial meeting. The material listed in addendum B was made available at the second meeting at the National Archives. All members of both subpanels were allowed unlimited access to these materials for individual examination.

(207) On September 17, members of the larger subpanel met with Drs. James J. Humes and J. Thornton Boswell, who had performed the autopsy on Nov. 22, 1963, and with Dr. J. Lawrence Angel, a forensic anthropologist with the Smithsonian Institution, to discuss the procedures followed during President Kennedy's autopsy and the degree of fragmentation of the President's skull. On Sept. 22, 1977, the second subpanel was afforded the opportunity to hear the tape recording of the interview of Drs. Humes and Boswell conducted by the first subpanel. Both subpanels were shown a film and slide presentation of the assassination prepared by Robert Groden, which included the Zapruder film.

(208) The larger subpanel met on the afternoon of Sept. 18, 1977, at the House Office Building, Annex II, to discuss the individual findings and to commit to writing its opinions relative to the evidence viewed. At that meeting, it became apparent that the members were in substantial agreement with respect to the interpretation of the evidence.

(209) Members of the other subpanel met on the afternoon of Sept. 24, 1977, at the House Office Building, Annex II, to discuss their findings and opinions relative to their examination and reexamination of the evidence. Members of this group, who had previously publicly expressed differing interpretations of the evidence, were not in agreement as to the interpretation of all the evidence.

(210) The two subpanels selected Dr. Loquvam and Dr. Weston, respectively, to draft preliminary working reports. Dr. Weston subsequently drafted a report that incorporated the views of both subpanels.

(211) The members of the subpanels met together on Friday, Mar. 10, 1978, at the National Archives. Drs. Weston, Loquvam, and Baden also met with members of the photographic evidence panel that day to review selected photographs that had been enhanced using a photographic reexposure\* technique, as well as several other photographs arranged in pairs to permit stereoscopic visualization.\* Following that, all members of the forensic pathology panel met with members of the photographic panel to hear presentations concerning the photographic panel's interim work that might be relevant to that of the forensic pathology panel.

(212) The reports of the two pathology subpanels, being in essential agreement as to the pathology evidence, were then combined, with the understanding that any panel member not concurring with any statement could express a dissenting opinion that would be noted and incorporated in the body of the report.

(213) On Saturday, Mar. 11, 1978, members of the forensic pathology panel met again at the National Archives and deposed Dr.



John H. Ebersole, the radiologist who had taken the autopsy X-rays, and subsequently Dr. Pierre A. Finck, one of the pathologists who assisted in the autopsy. The pertinent portions of their testimony is summarized in section III of this report.

(214) During the early evening of Saturday, Mar. 11, members of the forensic pathology panel met with members of the photographic evidence and firearms panels, other experts, and members of the select committee staff to discuss and present each panel's findings and observations.

(215) On Sunday, March 12, members of the panel once again met at the House Office Building, Annex II, and discussed joint observations and the report previously prepared by Dr. Loquvam. During the discussion, Dr. Finck was interviewed at his request because of his concern that the views he expressed during his deposition the previous day may have been misunderstood. The panel adjourned in midafternoon on that date with the understanding that members of the photographic panel, assisted by either or both Drs. Petty and Coe, if necessary, would attempt to enhance further selected photographs of the President's posterior head and neck, anterior neck, and back, while Dr. Weston would represent the panel at a preliminary review of the computer-assisted image enhancement of selected photographs\* and X-rays. It was further agreed that Dr. Weston would prepare a second draft of the panel's report on behalf of the entire panel, using Dr. Loguvm's earlier draft and incorporating new information and suggestions from panel members and the committee.

## PART II: RECOMMENDATIONS FOR ADDITIONAL EXAMINATIONS, PROCEDURES, AND CONSULTATIONS BY NONPATHOLOGY DISCIPLINES

(216) The initial review of evidence available, listed in addenda A and B, led members of the subpanels and then the panel as a whole to offer the following suggestions for additional procedures, examinations and consultations to be conducted by specialists in nonpathology disciplines, with the understanding that such evidence might have significance in the panel's final observations and conclusions:

(217) 1. Photographic experts should examine the individual photographs to insure that none of them has been retouched or otherwise altered.

(218) 2. The X-rays identified as those taken of President Kennedy prior to and during the course of the autopsy, and of Governor Connally during his hospitalization, should be examined by a photographic expert and subsequently by a forensic odontologist\* and a radiologist for the following purposes:

- To insure validity of the identity of these X-rays by comparison with in-life\* films;
- To insure that the X-rays have not been altered since being taken, except as otherwise noted.
- To evaluate more completely, in order to determine their significance, the somewhat randomly distributed, small, radiopaque particles visible in the X-ray of the soft tissues lateral to the right, lower cervical spine of John F. Kennedy;
- To provide interpretation by a radiologist with experience in the examination of gunshot wounds.



(219) 3. The X-rays of particular importance should be examined to determined the desirability of subjecting all, or portions of them to a computer-assisted image enhancement process which might make possible more definitive interpretation, particularly of fracture lines. These X-rays include: the anterior-posterior \* and lateral views of the skull (numbered 1, 2, and 3 on the films); those of the thoracolumbar \* region (7 and 11); the chest anterior-posterior \* view (9); the right hemithorax,\* shoulder and upper arm, anterior-posterior \* view (8); and the left hemithorax, shoulder and upper arm, anterior-posterior \* view (10).

(220) 4. Those photographs considered most important should be considered for photographic enhancement.\* One procedure, re-graphy for definition,\* with varying degrees of exposure, might increase contrast. Computer-assisted image enhancement\* could be used to modify the photographs, rendering recognizable the variations in color or shade otherwise imperceptible to the human eye.

(221) These photographs include: the entrance wound in the upper back (4- by 5-inch positive color transparency\* No. 38. or 39 or correspondingly numbered 8- by 10-inch prints); the entrance wound at the back of the head (4- by 5-inch positive color transparency No. 42 or 43 or correspondingly numbered 8- by 10-inch color prints); the exit defect on the anterior neck (4- by 5-inch positive color transparency No. 40 or 41 or correspondingly numbered 8- by 10-inch black and white positive prints No. 13 or 14); and the area of the exit defect on the skull showing a semicircular defect in the bone (4- by 5-inch positive color transparency No. 44 or 45 or correspondingly numbered 8- by 10-inch color prints).

(222) 5. Soft X-ray \* and energy dispersive X-ray \* examination of pertinent portions of the clothing of President Kennedy and Governor Connally, particularly around the entrance and exit wounds, should be conducted to determine if they reveal particles of metal deposited by the missile. Any particles found should then be examined by neutron activation analysis \* to correlate their composition with missiles suspected of having perforated the clothing in these areas.

(223) 6. The panel should interview each member of the pathology team that conducted the original autopsy: Drs. Humes, Finck, and Boswell, and the radiologist assisting with the examination, Dr. Ebersole. These interviews are suggested as a means of elucidating the circumstances surrounding the autopsy, the restrictions, if any, perceived by the prosecutors, and the apparent discrepancy between the findings of the panel and the original pathologists as to the location of the entrance wound of the head. The interviews would also help in evaluating more fully the entire autopsy examination and report.

(224) 7. The panel should meet with Dr. J. Lawrence Angel, a forensic anthropologist at the Smithsonian Institution, to review the X-rays and photographs of the skull and skull bones to assist it in simulating a repositioning of the skull fragments within the defect of the right side of the skull and in locating more precisely the missile exit defect indicated by the beveling\* on two separately recovered skull fragments. (This meeting occurred on Sept. 17, 1977.)

(225) 8. Members of the panel or the committee or both should interview the surgeons who provided emergency care to President Kennedy

to determine more precisely the characteristics of the wounds as first noted on the President and to ascertain that medical information was not overlooked. It was further suggested that similar interviews be conducted with the surgeons and radiologists who provided treatment to Governor Connally in anticipation that such interviews might provide more precise and detailed information on the Governor's injuries, both external and internal, than had been documented in previous testimony or available reports.

(226) 9. The panel considered the potential value of additional ballistics tests with cadavers to simulate the wounds suffered by President Kennedy and Governor Connally, particularly because the panel determined that the entrance wound in the head was located considerably above the point described in the autopsy report, which had been used as the point of aim in previous experimental shootings. The actual, higher entrance location is on a more convex superior portion of the head, which would be an important fact to know to replicate more accurately the known injuries to the scalp and underlying skull than was accomplished in previous experiments. The panel considered experiments, using a comparable weapon, ammunition and target distance, wherein a wound or wounds would be inflicted in the upper back of cadavers, in an attempt to simulate the damage, angle and bullet track of the missile(s) which proceeded through President Kennedy and Governor Connally.

(227) The majority of the panel concurs that the difference between the effects of missiles on cadavers and living persons, the inability to duplicate completely all the factors that were present in the original shooting, and the limitations of information concerning the location of the entrance and exit wounds and the precise bullet track, would render such an experiment of limited and controversial value. While the experiment might eventually replicate the conditions of impact on the bodies of President Kennedy and Governor Connally, many attempts might have to be made before a valid replication could be obtained. To determine whether the replication was in fact valid or fortuitous would be difficult and might itself generate controversy.

(228) One panel member, Dr. Wecht, does not concur, but urges that such additional experiments be conducted, directed at the approximate wound locations, with several cadavers appropriately arranged so as to simulate the possible bullet track through the body. It is Dr. Wecht's opinion that without such tests, the single bullet theory cannot be scientifically defended; hence, he cannot but continue to reject this conclusion of the Warren Commission.

(229) 10. The panel requested a new medical examination of Governor Connally relative to the injuries he received in 1963. The panel considered the possibility that there might still be missile fragments in the Governor. The panel also requested consideration by experts in the field of neutron activation analysis\* as to any potential value of an analysis of such fragments at this date.

(230) 11. The panel members discussed the possible value of disinterring the remains of President Kennedy. All agreed that such examination could confirm the exact entrance point of the bullet that struck the back of the President's head, initially a point of disagreement between the pathologists who conducted the autopsy and the panel. (Subsequently, in his public testimony, Dr. Humes agreed with the panel's conclusion as to the location and disagreed with his



Warren Commission testimony and his earlier statement to the forensic pathology subpanel.) In addition, an examination of the remains would probably permit determination of both the nature and extent of the bony injury and skull defects, thus enabling, through reconstruction, a more precise determination of the location of the exit wound from the skull. Further, it might be possible to pinpoint the entrance wound in the upper back and the exit wound in the anterior neck with reference to fixed body landmarks and thus enable more precise determination of the angle of the bullet track through the thorax\* (back) relative to the body's axis. The majority of the panel concurs, however, that in the absence of photographic documentation of the body's precise position at the moment the missile struck the back, more accurate wound locations would be of limited value in determining the bullet's point of origin.

(231) Dr. Wecht, in disagreeing, points out that in the Zapruder film, the Stemmons Freeway sign obstructed the President from view for an interval of only approximately 0.9 second, during which Wecht assumes the shooting occurred. In his opinion, this interval was too short for there to have been sufficient movement to result in an alinement consistent with one bullet passing through both men.

(232) Neither the autopsy pathologists nor the panel, at this time, can determine the exact pathway and angle of this missile track in the President for reasons discussed subsequently in this report.

(233) 12. The panel strongly suggested that the committee undertake a vigorous effort to determine the fate of the missing microscopic slides, paraffin blocks,\* tissues from which they were prepared, and brain, and make these available to the panel for review. (A search was conducted, as described in an attached staff report.)

### PART III: OBSERVATIONS AND CONCLUSIONS DERIVED FROM THE EXAMINATION OF THE AVAILABLE EVIDENCE, INTERVIEWS, SPECIFICALLY REQUESTED ANCILLARY PROCEDURES, AND CONSULTATIONS

(234) The following is the consensus of the panel as to the medical facts of this homicide, based on the evidence available, listed in addenda A and B and developed from interviews and examinations.

#### DESCRIPTION OF PRESIDENT KENNEDY'S WOUNDS

(235) The President sustained two wounds from behind, caused by two missiles, one entering the upper right back and exiting the anterior (front) neck, the second entering high on the back of the head, partially fragmenting in the head, and exiting from the right side, front-parietal\* region, of the head. Documentation of these wounds is as follows:

##### *Entrance (inshoot) wound of the upper back and neck*

##### *1. Clothing—Suit jacket (back)*

(236) The suit is made of a lightweight, gray fabric that resembles a tropical worsted in a sack weave. The jacket collar, back and upper sleeves are stiff and stained with a dark brown substance resembling dried blood. The sleeves are slit, as are the front panels across the nipple line; this was done to facilitate rapid removal in the Parkland emergency room.



(237) Two defects are noted in the back of the jacket. The defect caused by the missile is described in an FBI report as follows:

Examination of the President's clothing revealed the presence of a small hole in the back of the coat and shirt. The hole in the back of the coat is positioned approximately  $5\frac{3}{8}$ -inches below the top of the collar and  $1\frac{3}{4}$ -inches to the right of the middle seam. (1) (See figs. 1 and 2, photographs of the suit jacket.)

That report goes on to describe the defects of the shirt and then states "[t]hese holes are typical of bullet entrance holes." (2)



FIGURE 1.—Photograph of the suit jacket, taken from the back, showing the bullet hole entrance.



FIGURE 2.—Photograph of the suit jacket taken from the front, showing the bullet hole entrance in the back. The suit jacket, shirt and tie were cut during emergency procedures at Parkland Memorial Hospital, Dallas, Tex., to afford easy removal.

(238) The second defect was artificially created in the FBI laboratory to obtain a sample of material for subsequent studies. It is located just below the collar and 3.3 centimeters to the right of the midline. It measures 0.9 centimeter in vertical diameter and 0.8 centimeter in transverse diameter. This defect does not penetrate the full thickness of the coat and was identified in the testimony of Special Agent R. A. Frazier of the FBI laboratory as the site of a control cloth sample removed and analyzed by the laboratory.

(239) The panel locates the defect created by the missile at 5 centimeters (approximately 2 inches) to the right of the middle of the coat and 13.5 centimeters (5.3 inches) below the top margin of the collar and identifies it as a gunshot defect measuring 1.5 centimeters in vertical diameter and 1 centimeter in transverse diameter and passing through all layers of cloth.

(240) Correspondence from J. Edgar Hoover, Director of the FBI, to J. Lee Rankin, General Counsel, Warren Commission, characterized the posterior holes in the clothing as follows:

The hole in the back of the coat and the hole in the back of the shirt were, in general, circular in shape and the ends of the torn threads around the hole were bent inward. These characteristics are typical of bullet entrance holes. (3)

The panel concurred that such a description of the undisturbed clothing would characterize entrance defects. No earlier reports indicated the dimensions of the defect in the coat, nor of that in the shirt. The intervening handling of the clothing prevents the panel from drawing any independent conclusions based on its own observations of the defect and surrounding fibers.

(241) The panel had access to the results of an earlier spectrographic analysis\* detailed within the above-referenced FBI report that states:

The evidence bullets submitted in this case are clad with copper metal. Spectrographic examination of the fabric surrounding the holes in the back of the coat and shirt revealed minute traces of copper. (4)

#### *2. Clothing—shirt (back)*

(242) The shirt is white with a thin triple gray stripe alternating with a thin triple brown stripe. The back, collar and upper sleeves are stiff and stained with a dark brown substance resembling dried blood.

(243) There is a defect in the shirt measuring 1.2 centimeters in vertical diameter and 0.8 centimeter in transverse diameter. It is in a location corresponding to the defect in the jacket, with its upper margin 14 centimeters (5.5 inches) below the upper margin of the shirt collar and 2.5 centimeters (approximately 1 inch) to the right of the midline of the shirt. This defect is also described in the FBI report:

The hole in the shirt back is located in the same relative area, being  $5\frac{3}{4}$  inches below the top of the collar and  $1\frac{1}{3}$  inches to the right of the middle. (5)

(244) A second defect was created in the shirt in order to obtain control cloth for FBI spectrographic analysis,\* as described in the above-referenced report. This manmade defect measures 1.7 centimeters (approximately 0.7 inch) in vertical diameter and 0.3 centimeter in horizontal diameter, and is located 14 centimeters below the upper collar border and 2.5 centimeters to the right of the midline of the shirt. (See fig. 3, a photograph of the missile defect in the back of the shirt.)





FIGURE 3.—Photograph of the shirt, taken from the front, showing bullet hole entrance in the back.

### *3. Photographs*

(245) The Panel examined photographs of the upper right back with the body on its left side; these included 8 inch by 10 inch black and white negatives and prints Nos. 11 and 12 and 4 inch by 5 inch positive color transparencies and prints. Nos. 38 and 39. (All photographs and X-rays were examined with and without the aid of a 10X magnifying lens.) Stereoscopic visualization\* of paired photographs\* Nos. 38 and 39 revealed a slight change in the position of the camera between the two exposures. Essentially the photographs con-

sist of a view of the right upper posterior thorax (back), with the camera in a position such that it would be approximately horizontal to the body if the body were erect, or at right angles to the skin surface and parallel to a sagittal plane \* of the body. Within each photograph is a centimeter ruler which overlies the midline of the back, extending approximately 2.5 centimeters above the upper wound margin and 2 centimeters below the lower wound margin, with its edge approximately 2.5 centimeters medial to the wound margin. The ruler is in the plane of focus of the wound, enabling reasonably accurate measurement of the wound, which is oval, with one end of the long axis between 2 o'clock and 3 o'clock and the opposite end between 8 o'clock and 9 o'clock. The maximum wound diameter, determined by interpolation from the photos, is 0.9 by 0.9 centimeter. The midpoint is estimated to be 13.5 centimeters below the right mastoid process\*, with the head and neck, as positioned within the photograph, 6 centimeters below the most prominent neck crease and 5 centimeters below the upper shoulder margin. (See fig. 4, a drawing of this wound, and fig. 5, a close-up photograph of it.)



FIGURE 4.—Drawing of the posterior thorax of President John F. Kennedy, revealing the general location and appearance of the entrance wound in the upper back.



FIGURE 5.—Close-up photograph of the entrance wound in the upper back.

(246) There is a sharply outlined area of red-brown to black around the wound in which there is dried, superficial denudation of the skin, representing a typical abrasion collar\* resulting from the bullet's scraping the margins of the skin at the moment of penetration. This is characteristic of gunshot wounds of entrance and not typical of exit wounds. This abrasion extends around the entire circumference, but is most prominent between 1 o'clock and 7 o'clock about the defect (with the head at 12 o'clock). In addition, there are several small lin-



ear, superficial lacerations or tears of the skin extending radically from the margins of the wound at 10 o'clock, 12 o'clock and 1 o'clock. These measure 0.1, 0.2 and 0.1 centimeter respectively. Photographically enhanced\* prints of photographs Nos. 38 and 39 reveal much more sharply contrasted color determination and, to some degree, more sharply outlined detail of the abrasion collar described above.

(247) Several members of the panel believe, based on an examination of these enhancements, that when the body is repositioned in the anatomic position\* (not the position at the moment of shooting) the direction of the missile in the body on initial penetration was slightly upward, inasmuch as the lower margin of the skin is abraded in an upward direction. Furthermore, the wound beneath the skin appears to be tunneled from below upward.

(248) The panel concurs with the assessment that the color photographs made during the autopsy of President Kennedy are authentic, as described in correspondence of Frank Scott of the photographic evidence panel, dated June 13, 1978.(6)

#### 4. X-rays

(249) As is detailed in a late section, "Course of the Missile Through the Body," the X-rays demonstrate that the missile did not strike the scapula\* (wing bone) or ribs and did not remain in the body. This evidence, coupled with the photographs, indicates that the entrance perforation is medial to the scapula and superior to the ribs.

#### 5. Autopsy report

(250) The autopsy report, known technically as the autopsy protocol, submitted by Drs. James J. Humes, J. Thornton Boswell, and Pierre A. Finck, localized and characterized the wound in the right upper back:

Situated on the upper right posterior thorax, just above the upper border of the scapula there is a 7 millimeter by 4 millimeter oval wound. This wound is measured to be 14 centimeters from the tip of the right acromion process\* and 14 centimeters below the tip of the right mastoid process.\*(7)

The original pathologists' localization of this wound by measurement to body landmarks which change with different body positions, and their failure to localize this wound relative to the usually accepted fixed body landmarks such as the heel, preclude reconstruction of the exact entrance point.

(251) An attempt to localize this wound more accurately is further frustrated by its designation on a drawing contained within the "autopsy descriptive sheet," which was prepared during the autopsy. In this drawing (see fig. 6, a reproduction of the drawing), a small

## AUTOPSY DESCRIPTIVE SHEET

MMS PATH-8 (1-63)

## AUTOPSY

NAME # A-63 #27 DATE 1-2-63 HR. STARTED \_\_\_\_\_ HR. COMPLETED \_\_\_\_\_

NAME: \_\_\_\_\_ RANK/RATE \_\_\_\_\_

DATE/HOUR EXPIRED: \_\_\_\_\_ WARD \_\_\_\_\_ DIAGNOSIS \_\_\_\_\_

PHYSICAL DESCRIPTION: RACE: \_\_\_\_\_ Obtain following on babies only:

Height \_\_\_\_\_ in. Weight \_\_\_\_\_ lb. Hair \_\_\_\_\_ Color \_\_\_\_\_

Crown-rump \_\_\_\_\_ in. Crown-heel \_\_\_\_\_ in.

Color eyes \_\_\_\_\_ Pupil (Rt) \_\_\_\_\_ mm, (Lb) \_\_\_\_\_ mm Circumference:

Head \_\_\_\_\_ in. Chest \_\_\_\_\_ in. Abdomen \_\_\_\_\_ in.

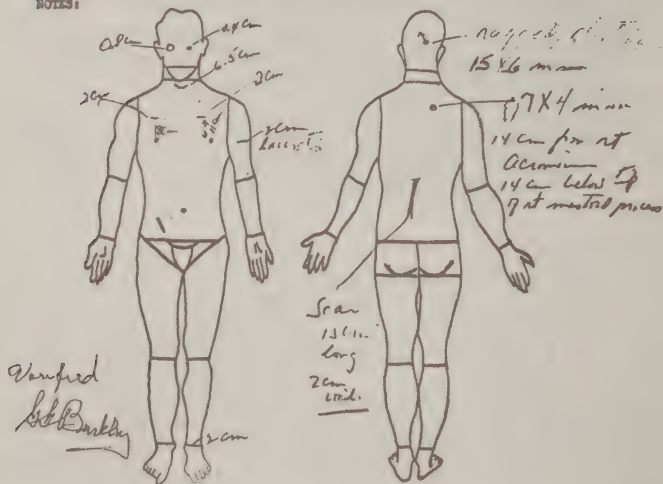
WEIGHTS: (Grams, unless otherwise specified)

LUNG, RT. 330 KIDNEY, RT. 130.5 ADRENALS, RT. \_\_\_\_\_LUNG, LT. 290 KIDNEY, LT. 140 ADRENALS, LT. \_\_\_\_\_BRAIN \_\_\_\_\_ LIVER 160 PANCREAS \_\_\_\_\_SPLEEN 90 HEART 350 THYROID \_\_\_\_\_

THYMUS \_\_\_\_\_ TESTIS \_\_\_\_\_ OVARY \_\_\_\_\_

HEART MEASUREMENTS: A 7.5 cm. P 9 cm. T 12 cm. M 10 cm.LVM 1.5 cm. RVH .4 cm.

## NOTES:



Pathologist

FIGURE 6.—Reproduction of "Autopsy Descriptive Sheet" drawing depicting anterior and posterior views of the body, with wounds as sketched by the autopsy pathologists

circle at the junction of the upper one-third and lower two-thirds of the right posterior back is characterized with the legend "7 millimeters by 4 millimeters 14 centimeters from the rt. [right] acromion plus 14 centimeters below tip of rt. [right] mastoid process." (8) The panel considered the location of the wound as it appears in photograph No. 38 or figures 4 and 5 in relation to this drawing. The panel concludes that the drawing was merely a crude representation used as a work-

sheet primarily to assist in the preparation of the final report and was not necessarily an exact representation of the wound. The majority of the panel agrees that if the wound were located as low as represented on the worksheet, it probably would have penetrated and collapsed the right lung, an effect that would have been apparent on the initial chest X-ray.

*Exit (outshoot) wound of the anterior (front) neck*

*1. Clothing—shirt (front)*

(252) Examination of the shirt reveals a slit-like defect in the upper left front portion, 1.4 centimeters below the topmost buttonhole. This defect measures 1.4 centimeters in length, with its long axis parallel to the long axis of the body. There is a corresponding slit-like defect 1.5 centimeters below the center of the button on the right. This defect measures 1.5 centimeters in length and is also parallel to the long axis of the body (See fig. 3, a photograph of the shirt.)

*2. Clothing—Necktie*

(253) Examination of the necktie in the normal knotted position reveals a linear defect along the left lateral margin of the knot. This defect measures 0.7 by 0.4 centimeter and involves only the outer facing of the tie. The lining is not altered.

(254) These clothing changes were characterized in initial examination by the FBI laboratory:

A ragged, slit-like hole approximately one-half inch in length is located in the front of the shirt seven-eighths inch below the collar button. This hole is through both the button and buttonhole portions of the shirt due to the overlap. This hole has the characteristics of an exit hole for a projectile. No bullet metal was found in the fabric surrounding the hole in the front of the shirt. A small elongated nick was located in the left side of the knot of the tie, Q24 [FBI designation], which may have been caused by the projectile after it had passed through the front of the shirt.(9) (See fig. 7, a photo-





FIGURE 7.—Photograph of the necktie, showing the bullet defects

graph of the tie.) X-ray and other examinations of the clothing revealed no additional evidence of value.

(255) In the correspondence from Hoover to Rankin, referred to earlier, Hoover further characterized the defect in the shirt:

The hole in the front of the shirt was a ragged, slit-like hole and the ends of the torn threads around the hole were bent outward. These characteristics are typical of an exit hole for a projectile. A small elongated nick was present in the left

side of the knot of the tie. This nick may have been caused by the projectile after it passed through the front of the shirt. No additional observations relative to the nick could be made due to the characteristics of the nick.(10).

(256) While the FBI laboratory's initial description did not offer evidence concerning the direction of the fibers, the observations in this letter were substantive evidence of the direction of the penetration, provided that the position of the threads had not changed in the interim. As stated previously, the panel itself cannot assess evidentiary significance to the fiber direction because of the numerous intervening examinations.

(257) Careful attention was paid to the possible presence of any contaminant visible at the margins of any of these defects. The panel suggested examination of appropriate portions of the clothing of the President and the Governor by soft X-ray\* and energy dispersive X-ray\* and, if warranted thereafter, by neutron activation analysis.\* The first two types of nondestructive examinations were concluded, but there was insufficient metal present for neutron activation analysis. (The report of the tests is contained in addendum F.)

(258) The tests were undertaken to:

1. Determine if any particles of missile still remained on the clothing.
2. Analyze the missile fragments, if any, and define the elemental nature of them.
3. See if any correlation might be made between the elements found and missile behavior after striking J.F.K. and J.B.C.(11)

(259) The soft X-ray\* examination revealed the presence of some very tiny particles of foreign material in the back of the shirt at the margins of the defect, but no copper or lead was found by energy dispersive X-ray analysis.\* The energy dispersive X-ray analysis\* yielded a borderline count for copper in the area of the back defect on the President's jacket and in the area of the right front defect on his shirt. Iron, apparently from the bloodstain, was detected about the defect in the jacket.

(260) The panel considers that at this time the appearance of the upper back skin wound, particularly its abrasion collar, is more significant in determining the direction of the missile's passage than examination of the clothing. The limited amount of foreign material demonstrated by soft X-ray and energy dispersive X-ray analysis\* was considered insufficient for further characterization by neutron activation analysis\* by Vincent P. Guinn, Ph. D., of the University of California at Irvine, the committee's consultant in this area. The panel agrees that slit-like defects in clothing are common and typical at missile exit sites.

### 3. Photographs

(261) The panel examined photographs of the President's face, neck, and upper torso taken from above and to the right which reveal the scalp lacerations in the right frontal and temporal\* regions and a tracheotomy incision in the neck. The photographs included: Black and white 8- by 10-inch prints No. 13 and 14; 4- by 5-inch positive color

transparencies and prints Nos. 40 and 41; and correspondingly numbered 8- by 10-inch color prints. There is no ruler in the photographs, so measurements are approximate. The maximum transverse diameter of the incision in the neck is approximately 5 centimeters, while the maximum vertical diameter is approximately 1.5 to 2 centimeters; it is approximately 4 centimeters below the shoulder line and 3 centimeters above the suprasternal notch.\* (See fig. 8, a drawing of the tracheotomy incision and fig. 9, a closeup photograph of the tracheotomy incision.)



FIGURE 8.—Drawing of the anterior neck and thorax, showing the general location and appearance of the tracheotomy incision.



FIGURE 9.—Closeup photograph of the tracheotomy incision.



(262) There is a semicircular missile defect near the center of the lower margin of the tracheotomy incision, approximately in the midline of the neck, with margins which are slightly denuded and reddish-brown.

(263) Although the black and white prints are more sharply focused than the color photographs, none are clear. Figure 19 shows the wound approximately in the midline of the anterior neck. The panel suggested photographic\* or computer-assisted enhancement\* of either one or both of black and white photographs Nos. 13 and 14, inasmuch as they were in sharper focus and the results might better delineate the margins of the exit defect in the anterior neck which was not properly identified and documented at the time of autopsy.

#### 4. X-rays

(264) As is detailed in a later section ("Course of the Missile Through the Body"), the X-rays indicate that the missile track proceeds toward the midline of the body. This analysis is based on the fracture of the transverse process of T-1 and the air in the soft tissues, which probably resulted from the laceration of the trachea. The air could have been caused by either a bullet laceration of the trachea or the surgeon's tracheotomy. The X-rays show that no missile is present and therefore that the bullet exited the body without causing any fracture other than of the lateral transverse process.

#### 5. Autopsy Report

(265) The autopsy report characterized the anterior neck wound as:

Situated in the low anterior neck at approximately the level of the third and fourth tracheal rings is a 6.5-centimeter long transverse wound with widely gaping irregular edges. (12)

The appearance of this wound was further characterized by Dr. Humes in his report as follows:

The wound presumably of exit was that described by Dr. Malcolm Perry of Dallas in the low anterior cervical\* region. When observed by Dr. Perry, "the wound measured" a few mm in diameter, however it was extended as a tracheotomy incision and thus its character is distorted at the time of autopsy. However, there is considerable ecchymosis of the strap muscles of the right side of the neck and of the fascia\* about the trachea adjacent to the line of the tracheotomy wound. (13)

(266) This wound is further depicted in the Autopsy Descriptive Sheet, in which the anterior view, showing a semicircular line with its convex border pointing inferiorly below the lower crease of the neck, bears the legend "6.5 centimeter." (See fig. 6.) It is conspicuously unclear from the autopsy report alone that during autopsy, the pathologists were unaware and failed to recognize that there was a missile perforation in the anterior neck. This may account for the fact that the neck, trachea, strap muscles, and spine were not dissected and examined.

### 6. *Statements of the surgeons*

(267) Dr. Perry testified before the Warren Commission that:

In the lower part of the neck below the Adams Apple was a small, roughly circular wound of perhaps 5 mm. in diameter from which blood was exuding slowly.(14).

In a committee interview, Dr. Perry further characterized the wound:

Dr. Perry began by stating that one of the wounds that JFK had suffered was "about  $\frac{1}{3}$  of the way" up on the anterior aspect of the neck. Dark blood (a sign of insufficient oxygen) was oozing from the wound when Dr. Perry first observed JFK. Dr. Perry believes that the wound measured approximately 6-7 millimeters in size and was roughly round, although he couldn't state for sure since combating the two primary medical emergencies of restoring breathing and stopping bleeding prevented him from even taking the time to wipe the blood from the wound.(15)

The report on the interview continued:

Dr. Perry said that Dr. Jones, who was already treating JFK when Perry arrived, had inserted a tube down the trachea to facilitate breathing but that the air passage still seemed blocked. Due to this dilemma, Dr. Perry determined that a tracheotomy was necessary "then or never" and therefore made a transverse incision straight through the bullet wound on the anterior aspect of the neck at approximately the second or third tracheal ring.(16)

(268) Dr. Perry declined to express an opinion to the Warren Commission on the origin of the missiles that caused the damage. He explained:

I didn't clearly identify either an entrance or an exit wound. In the press conference I indicated that the neck wound appeared like an entrance wound, and I based this mainly on its size and the fact that exit wounds in general tend to be somewhat ragged and somewhat different from entrance wounds. Now, this doesn't pertain, of course, in bullets that are tumblers,\* and many bullets, especially fired from the hand guns and this sort of thing, tend to tumble, and as a result, they make keyhole injuries and various things. But, in general, full-jacketed bullets make pretty small entrance holes. And so I don't really know. I thought it looked like an entrance wound because it was small, but I didn't look for any others, and so that was just a guess. (17)

(269) Dr. C. James Carrico characterized the wound in the anterior neck as: "One small penetrating wound of the ant. (anterior) neck in lower third."(18) Dr. Carrico further characterized this wound in a Select Committee staff interview:

My total recollection of that wound, it was, a small, fairly circular wound, with material issuing from it. And that's really my total recollection.(19)

When asked whether he was able to draw any conclusions about the direction in which the missile had been passing, Dr. Carrico said "not for sure." (20)

(270) The panel considered the appearance of the wound in the anterior neck as initially described and subsequently altered. It is of the opinion that such a wound, uniformly regular in shape and small in size, might be anticipated from an intermediate or even high velocity missile if the tissues through which the missile exited were shored, buttressed or otherwise reinforced by clothing or other external objects that would minimize the outward displacement of the skin and underlying superficial tissue and consequent tearing and distortion of these tissues. The similarity between entrance and shored exit wounds may extend to the production of clothing abrasion patterns, that is, the imprint of the fabric of the clothing on the skin, because the missile, prior to exiting through the skin, forces the skin against the overlying restraining clothing.

(271) The panel members agree that the fabric of the shirt and tie and their anatomic relationship to the underlying missile wound might have served as sufficient reinforcement to diminish distortion of the skin. Several panel members are also of the opinion that an unshored exit wound of a missile of comparable size and velocity might be similar if the missile were not misshapen by striking a substantial bone within the body. The panel believes that it would be reasonable for a surgeon not to appreciate or even consider the significance of the clothing in terms of the wound shape produced, especially if the clothing had been removed prior to his initial examination, as was described within the above-referenced exhibits and interviews. The panel further notes that the shoring or buttressing effect of the wound by the clothing might serve to seal the defect in the President's trachea if he rotated his head, thus permitting him to speak after this wound was inflicted.

### *Course of the missile through the body*

#### *1. Photographs*

(272) There is no photographic evidence available that shows any of the internal injuries described by the pathologists within the trunk of the body. Dr. Humes recalled directing that a single photograph of the upper interior aspect of the right thoracic (chest) cavity be taken to illustrate the hemorrhage\* just exterior to the pleura (lining) of this cavity, adjacent to the missile track (21). There is, however, no such photograph among those in the collection, although there is one 4 by 5 inch positive color transparency on which there is no image.

#### *2. X-rays*

(273) The panel examined X-rays of the anterior-posterior\* view of the thoracicolumbar\* region (No. 7); the anterior-posterior\* view of the right neck, thorax (chest) and upper arm (No. 8); the anterior-posterior\* view of the chest (No. 9); the anterior-posterior view of the left neck, thorax (chest) and upper arm (No. 10); and the anterior-posterior\* view of the thoracicolumbar\* region (No. 11). X-ray No. 9 had been taken before the start of the autopsy; X-rays (Nos. 7, 8, 10,



11, and 14) were taken after removal of the internal organs. (See addendum J for a statement regarding the authenticity and description of the X-rays.)

(274) The panel noted a general haziness and poorly defined decrease in radiodensity\* in the neck tissues just above the right chest cavity in films 8 and 9, and attributed this to interstitial emphysema.\* This was probably related to the surgical tracheotomy or missile injury to the trachea, followed by positive pressure insufflation\*, with a slight escape of air into the adjacent tissues. Continued breathing by the President, possible even after the trachea had been perforated by the missile because the overlying defect was more or less sealed by the shirt and necktie, could also have caused air to leak into the adjacent soft tissues.

(275) The panel noted a number of small, radiopaque densities apparent in the No. 8 film and not apparent in No. 9. With one exception, these densities measured less than 0.1 centimeter in diameter and appeared to be more densely aggregated in the area immediately lateral to the right transverse processes of the seventh cervical (C-1) and first thoracic vertebrae (T-1). The panel took special note of a slightly larger shadow immediately lateral to the right transverse process of the seventh cervical vertebra. (See figs. 10 and 11, photographs of X-rays 8 and 9.)



FIGURE 10.—Photograph of an anterior-posterior X-ray of the neck and chest (from autopsy X-ray No. 8), showing small radiopaque densities adjacent to the transverse process of C-6 and C-7.



FIGURE. 11.—Photograph of the anterior-posterior X-ray of the neck and chest (from film No. 9), showing small radiopaque densities adjacent to the transverse process of C-6 and C-7.

(276) The forensic pathology panel requested that consultant radiologists review these opacities. Dr. G. M. McDonnel of Los Angeles indicated that the smaller shadows were randomly distributed on the X-rays in other locations far removed from this portion of the body. They were found even in films that did not overlie the trunk itself, such as in X-ray film No. 13 of the President's pelvis and upper thighs. Dr. McDonnel, who had served as an X-ray consultant to the coroner/medical examiner in Los Angeles and had had experience in such analysis, interpreted the shadows as artifacts not uncommonly caused by foreign materials on the film or in the developing solutions.

(277) Dr. McDonnel further noted that the larger shadow was not present in the initial films of the thorax (film No. 9), but only in subsequent films taken after removal of the thoracic organs, suggesting again that this shadow was an artifact. Dr. McDonnel's complete report, which also authenticates the X-rays by comparison with films taken while the President was living, is contained in a letter dated August 4, 1978, addressed to the select committee, and is incorporated in its entirety into this report as addendum C.

(278) The panel noted an interruption in the continuity of the right transverse process of the 1st thoracic vertebra, much more clearly delineated in the computer-assisted enhancement\* of film No. 8. Dr. David O. Davis, M.D., professor and chairman of the department of radiology at the George Washington University Hospital and Medical School, Washington, D.C., also observed these same findings, both on



the original X-ray films and on the computer-assisted enhancement\* of these films. Dr. Davis' complete report is contained in a memorandum to the committee dated August 23, 1978. (This letter, in its entirety, is incorporated in this report as addendum D.)

(279) Increased radiolucency,\* most probably caused by the interstitial emphysema\* noted earlier, rendered it virtually impossible to ascertain whether or not there was a similar fracture of the right transverse process of the seventh cervical vertebra. Norman Chase, M.D., professor and chairman of the department of radiology of New York University School of Medicine—Bellevue Hospital Medical Center, also examined the X-rays and their computers-assisted enhancements\* on Feb. 27, 1978. He noted the presence of a metal fragment or artifact in the area of the transverse process that was definitely not a bone fragment. He observed air in the subcutaneous tissue in the same region, which he concluded was caused by the passage of a missile or air or both entering the region due to the tracheotomy incision. He said the 1 by 2.5 millimeter object was too small and dense to be bone; rather, the little trail of dots near the fragment was indicative of artifacts. Dr. Chase said that if a fracture was present in T-1, it was peculiar in that there was no displacement of the bone. He suggested that enhancement of X-ray No. 9 might provide additional information.

(280) William B. Seaman, M.D., professor and chairman of radiology of Columbia Presbyterian Hospital and Physicians and Surgeons Medical School in New York City, also examined the X-rays:

Regarding the neck X-ray, Dr. Seaman said there was a fragment-like object present near the transverse process which was too dense to be bone ('fairly confident'). He said the transverse process appears normal with air present (possibly byproduct of tracheotomy), calling it "\* \* \* highly suspicious compared with the other side." He thinks he can "\* \* \* see the fragment separate (also in No. 9) and concludes there is a possible fracture in C-7.(22)"

### 3. Autopsy report

(281) The autopsy report characterized the internal injuries and missile path:

2. The second wound presumably of entry is that described above in the upper right posterior thorax. Beneath the skin there is ecchymosis\* of subcutaneous tissue and musculature.\* The missile path through the fascia and musculature cannot be easily probed. The wound presumably of exit was that described by Dr. Malcolm Perry of Dallas in the low anterior cervical region \* \* \*. However, there is considerable ecchymosis\* of the strap muscles of the right side of the neck and of the fascia\* about the trachea adjacent to the line of the tracheotomy wound. The third point of reference in connecting these two wounds is in the apex (supra-clavicular portion)\* of the right pleural cavity. In this region there is contusion\* of the parietal pleura and of the extreme apical portion of the right upper lobe of the lung. In both instances the diameter of contusion\* and ecchymosis\* at the point of

maximal involvement measures 5 centimeters. Both the visceral and parietal pleura are intact overlying these areas of trauma. (23)

(282) See figure 12, a drawing of these anatomic structures, injuries to them, and possible trajectories on the position of the body.

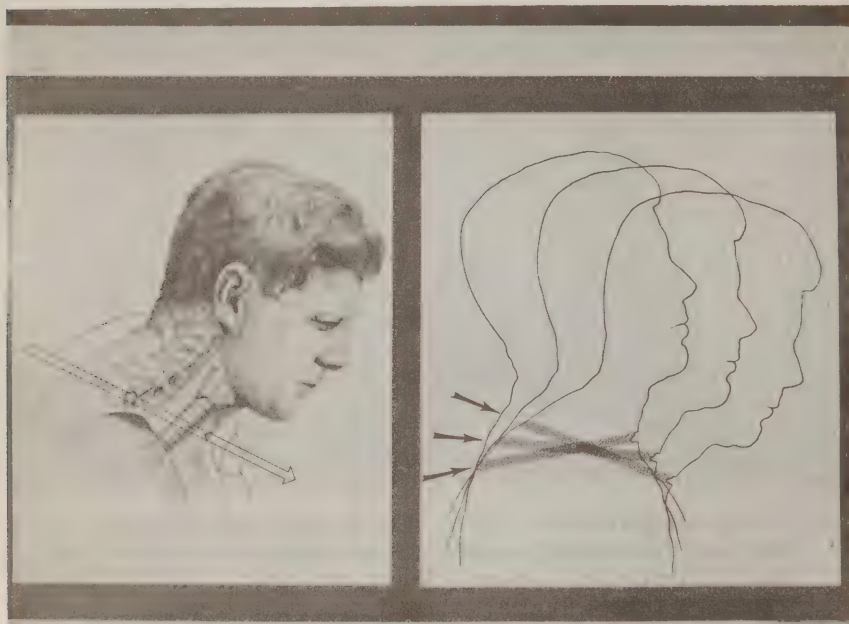


FIGURE 12.—Drawing of the lateral cross-section of the chest, depicting the visceral and parietal pleura, lower neck and right lung, with the injuries described to them. Also depicted is a drawing demonstrating the possible trajectories through the neck of President Kennedy, depending on the position of the body.

(283) Further evidence of internal injury in the thorax is reflected in the autopsy pathologists' description of the lungs:

The lungs are of essentially similar appearance the right weighing 320 grams, the left 290 grams. The lungs are well aerated with smooth glistening pleural surfaces and grey-pink color. A 5-centimeter diameter area of purplish red discoloration and increased firmness to palpation is situated in the apical portion of the upper right lobe. This corresponds to a similar area described in the overlying parietal pleura. Incision in this region reveals recent hemorrhage into pulmonary parenchyma.\* (24)

(284) The autopsy report makes no reference to any defect in the trachea, although this was described by the attending surgeons. Of particular interest relative to the location of the missile wound in the right neck is the description of the thoracic cavity within the report:

The bony cage is unremarkable. The thoracic organs are in their normal positions and relationships and there is no increase in free pleural fluid. The above described area of contusion\* in the apical portion of the right pleural cavity is noted. (25)

(285) Again, had the wound of entrance been below the uppermost extension of the right lung, this lung would have collapsed and blood would have been present within the cavity.

(286) Correspondence of Dr. Finck, dated February 1, 1965, and addressed to Brig. Gen. J. M. Blumberg, contained these observations concerning the pathway of the missile in the neck:

This wound cannot be probed with the soft probe available. There is subpleural hemorrhage in the right apical mesial region. The apex of the right lung is hemorrhagic, without laceration of the pleura. On the basis that there is a wound possibly of entrance, which cannot be probed through the body, I suggest X-ray films be taken, anteroposterior and lateral, of the entire body, before going any further with the autopsy. This radiologic survey does not reveal any major missile in the President's cadaver. There is a recent tracheotomy wound (transversal incision) with moderate hemorrhage in the subcutaneous tissue. Thanks to a telephone call from commander Humes to Dallas, I found out later that the surgeon in Dallas had extended the exit wound in the anterior aspect of the neck to make his tracheotomy. The tracheotomy wound was examined by the three prosectors. None of us noticed a bullet wound along its course. The organs of the neck were not removed: The President's family insisted to have only the head examined. Later, the permission was extended to the chest. (26)

(287) The summary in the autopsy report includes additional reference to the pathway of this missile:

\* \* \* entered the right superior posterior thorax above the scapula and traversed the soft tissues of the supra-scapular and supra-clavicular portions of the base of the right side of the neck. This missile produced contusions\* of the right apical parietal pleura and of the apical portion of the right upper lobe of the lung. The missile contused the strap muscles of the right side of the neck, damaged the trachea and made its exit through the anterior surface of the neck. As far as can be ascertained, this missile struck no bony structures in its path through the body. (27)

(288) The autopsy report makes no further reference to the wound in the front of the neck.

#### *4. Interviews with the surgeons*

(289) In his interview with the committee, Dr. Perry described a laceration on the right lateral side of the trachea. He did not recall precisely how he initially characterized it, but in his interview said, " \* \* \* it was on the right side of the trachea \* \* \* it was incomplete \* \* \* ." Further,



I don't remember whether it was a third or a quarter of the circumference \* \* \* I can't remember exactly. There was a laceration. The bruising I mentioned was in the apical pleural and the strap muscles. The trachea was clearly lacerated. (28)

(290) Dr. Perry's interview was also of interest relative to the possibility of the wound being low enough to have penetrated the right thoracic cavity. He said that he had placed a chest tube in the right thoracic cavity. Specifically:

I surmised there might be a hemothorax (blood within the thoracic cavity) or pneumothorax (air within the thoracic cavity) because, not knowing the trajectory of the missile, and when I saw the bruised apical pleural and there was some bubbly blood in that area, \* \* \* I didn't know whether that blood had been frothed a little bit as a result of air coming out of the trachea in our attempt to breathe for him or whether it was coming out of a lung. And as a result, since a tension pneumothorax or serious chest injury could have obviously been a serious problem, why we elected to put in a chest tube. But the chest tube, I later learned, was not necessary because the chest cavity was not violated. (29)

(291) He later explained that he did not become aware that the chest cavity had not been violated until he reviewed the autopsy report.

(292) Dr. Perry further indicated in this interview that there was "essentially very little bleeding." (30) Asked if he believed that a major arterial injury had been inflicted, particularly to the adjacent common carotid artery, he said that:

Even if he had had a major arterial injury, why he might have bled out and there wouldn't have been much (blood); but there was no evidence of a major arterial injury. And the artery, of course that's closely applied to the trachea, is the common carotid artery at that level. But it was not injured. (31)

(293) Description of the autopsy procedure makes no reference to removal or dissection of the neck organs nor of examination of the arteries of the neck. Dr. Finck testified on February 24, 1969:

I was interested in the track and I had observed the conditions of bruising between the point of entry in the back of the neck and the point of exit at the front of the neck, which is entirely compatible with the bullet's path.

When asked, "But you were told not to go into the area of the neck, is that your testimony?", his answer was, "From what I recall, yes, but I don't remember by whom." Queried further, "Did you attempt to probe this wound in the back of the neck?", his answer was, "I did." Counsel, on learning of his difficulty in attempting to probe the missile pathway, asked: "Isn't this good enough reason to you as a pathologist to go further and dissect this area in an attempt to ascertain whether or not there is a passageway here as a result of a bullet?" Dr. Finck's answer was, "I did not consider a dissection of the path." (32)

*Entrance (inshoot) wound of the back of the head*

*1. Clothing*

(294) The bullet perforated no clothing prior to its penetration into the skin of the posterior scalp.

*2. Photographs*

(295) The panel examined photographs of the back of the head, including: Black and white negatives and prints Nos. 15 and 16; color transparencies Nos. 42 and 43; and correspondingly numbered color prints of the back of the head. These were studied with both the naked eye and 10X magnification. The photographs again all appear to have been taken from approximately the same position, and stereoscopic visualization\* of the two 4 by 5 inch color transparencies enables three-dimensional perception. In the center of the photographs is a vertical centimeter ruler, which, by stereoscopic visualization,\* is demonstrated to be slightly closer to the camera than the adjacent skin surface. The upper portion of the ruler, which is in sharpest focus, is adjacent to a slightly oval scalp defect located in the "cowlick" area of the scalp just above or superior to a line drawn between the superior or upper margins of the area. (See fig. 13, a drawing of the back of the President's head.) This defect is partially covered by hair and dried blood. This wound is located considerably above the occipital protuberance,\* slightly to the right of the midline, and approximately 13 centimeters above the most prominent neck crease. It has a maximum vertical diameter in the photograph of approximately 1.5 to 2 centimeters, and a maximum transverse diameter of approximately 0.9 centimeter.



FIGURE 13.—Drawing depicting the posterior head wound. Note also the position "white mass," described later.

(296) Accurate reconstruction of the exact dimensions of the wound is difficult because the ruler and wound are in different planes of focus. The long axis of the wound more closely approximates a vertical angle than that depicted within the "Autopsy Descriptive Sheet." (See fig. 6.) The inferior margin of this wound, from 3 to 10 o'clock, is surrounded by a crescent-shaped reddish-black area of denudation, again presenting the appearance of an abrasion collar, resulting from the rubbing of the skin by the bullet at the time of penetration. From 12



to 3 o'clock, there is a suggestion of undermining, that is, tunneling of the tissue between the skin surface and the skull. Three small linear lacerations or tears of the skin, measuring less than 0.2 centimeter, in length, extend radially from the margins of the defect at 11 o'clock, 12 o'clock, and 3 o'clock. (See fig. 14, a close-up photograph of this wound.)



FIGURE 14.—Close-up photograph of the posterior head wound.

(297) An irregular, somewhat rectangular white object is also seen in these photographs, near the lower margin at the scalp hair at a point which most of the panel considers to be consistent with a localization slightly to the right of, and most likely below, the occipital protuberance.\* The panel agrees that the object is dried brain tissue.

(298) Examination of the enhanced photographs\* prepared from the 4 by 5 inch color transparency of the photograph of the back of the head (print No. 42) reveals more sharply contrasted detail of the wound described in the upper occipital region and the dried brain tissue in the lower occipital region. Stereoscopic visualization\* of this fragment indicates that it is adherent to and on the surface of the hair. Computer-assisted image enhancement\* of this photograph reveals a dark oval shadow within the margins of the scalp perforation in the cowlick area which may be the perforation of the underlying skull. The hole in the scalp lines up with the hole in the skull. The X-rays also locate the skull defect at this point.



FIGURE 15.—Close-up photograph of the “white mass,” dried brain tissue, situated in the lower occipital region.

(299) Examination of the dried brain tissue in the lower occipital region\* by computer-assisted image enhancement\* also clearly demonstrates that it is on the surface of the hair. Such enhancement further provides some three-dimensional characterization. (See fig. 15, a close-up photograph of the dried brain tissue.) All members of the panel agree that the upper scalp wound, the location of which is identified by X-rays as approximately 10 centimeters (as measured on the

X-ray) above the external occipital protuberance,\* is a typical entrance wound. All concur in its striking similarity to the entrance wound in the upper back. All agree that the white material is a piece of brain tissue and that it has no relationship to the location of the entrance wound, despite the interpretations of the autopsy pathologists in their Warren Commission testimony and interviews.

(300) Stereoscopic visualization\* of the inside of the cranial cavity at its depth, after removal of the brain, reveals a semicircular beveled\* defect of the inner table in the posterior parietal area to the right of the midline, from which fracture lines radiate corresponding to the entrance perforation indicated in the skull X-rays.

### *3. X-rays*

(301) Skull X-ray No. 2, a lateral view of the head, reveals rather marked disruption of the smooth contour of the skull on the right side in the temporal-parietal region, with multiple fractures through other portions of the skull. There is sharp disruption of the normal smooth contour of the skull 10 centimeters (as measured in the X-ray) above the external occipital protuberance,\* with suggested beveling\* of the inner table and with fracture lines radiating superiorly and inferiorly. (See fig. 16, showing the beveling process.) At this point



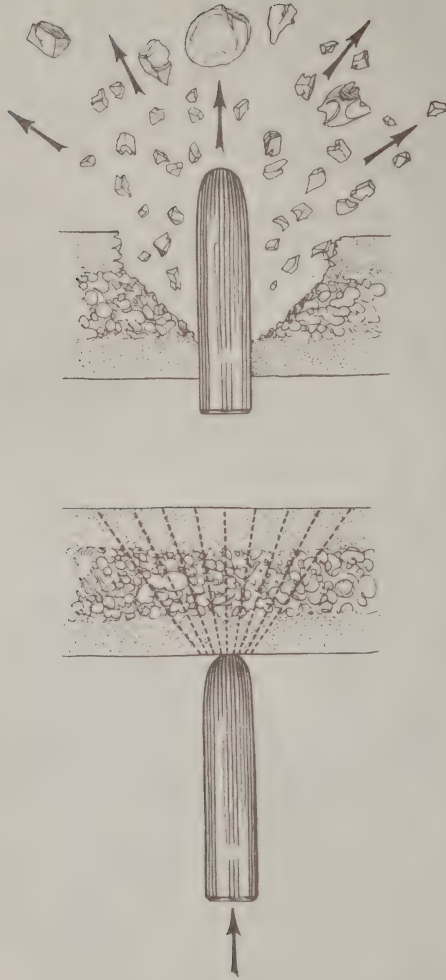


FIGURE 16.—Diagram depicting beveling which occurs on the interior surface to the site of entrance and exterior surface at the site of exit when a missile perforates the skull.

there is an irregular, radiopaque, sharply outlined bullet fragment. The skull defect, apart from its location, corresponds with the description within the autopsy report, in which it characterized as follows:

In the underlying bone is a corresponding wound through the skull which exhibits beveling\* of the margins of the bone when viewed from the inner aspect of the skull.(33)

(302) The location of the missile fragment and transverse fractures of the occipital region of the skull is also apparent in the anterior-posterior\* X-ray view of the skull (No. 1). It shows the missile fragment to be slightly to the right of the midline and in approximately the same vertical plane as in the above-described lateral view. (See figs. 17 and 18, photographs of X-rays Nos. 1 and 2 respectively.)



FIGURE 17.—Photograph of the anterior-posterior X-ray of the skull (autopsy X-ray No. 1), showing the occipital defect and adjacent missile fragment.



FIGURE 18.—Photograph of the lateral X-ray of the skull (autopsy X-ray No. 2), showing the occipital defect with beveling and adjacent missile fragment.

(303) Computer-assisted image enhancement\* of this film more sharply delineates the fracture lines and bone fragments, as well as the missile fragment in the occipital region. The defect in the skull and the inward beveling\* thereof provide definite evidence of an entrance wound of the head at a point corresponding to that noted by the panel in the upper back of the scalp, rather than “slightly above” the external occipital protuberance\* as indicated in the autopsy report, or in the lower part of the head near the hairline, as stated by the autopsy pathologists in their interviews with the panel. (See figs. 19 and 20, and computer-assisted enhancements\* of X-rays 1 and 2 respectively. See also fig. 21, a photograph of a premortem X-ray of the skull of the President, against which to compare the damage shown in autopsy X-rays Nos. 1 and 2.)



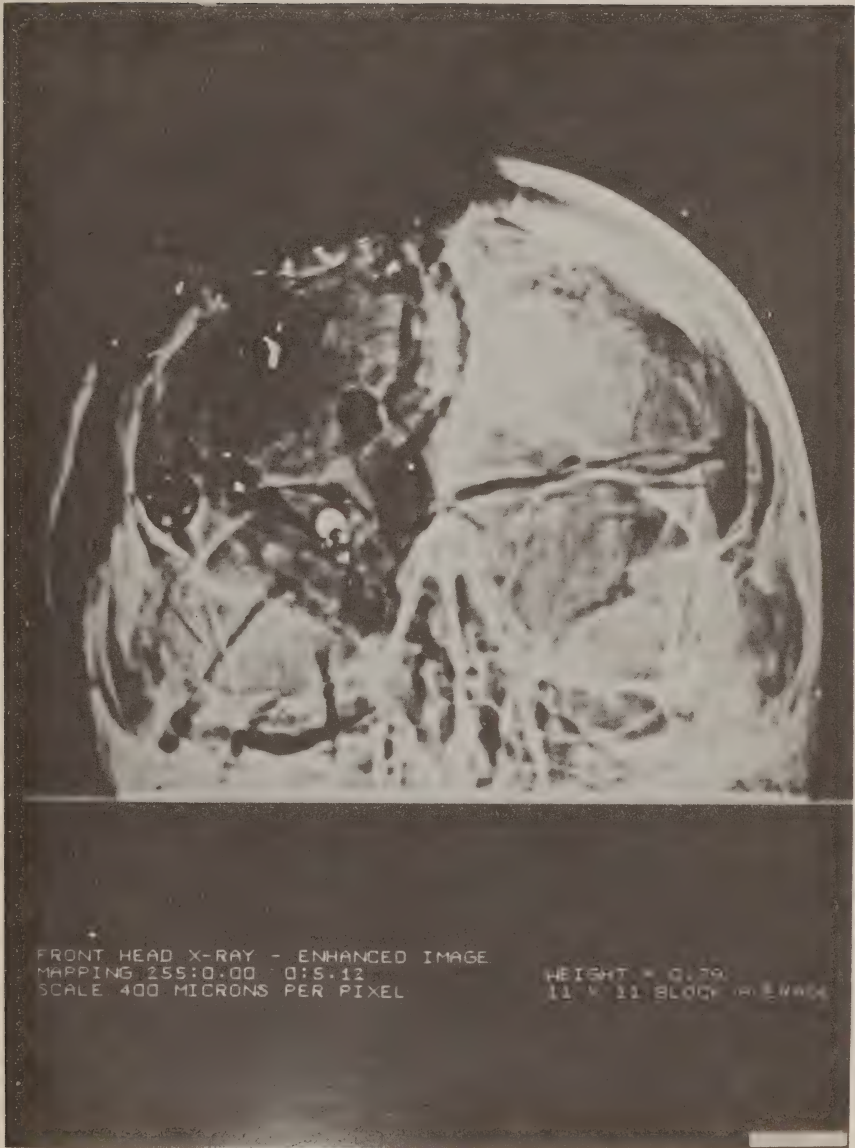


FIGURE 19.—Photograph of a computer-assisted image enhancement of anterior-posterior X-ray of the skull (autopsy X-ray No. 1).



FIGURE 20.—Photograph of a computer-assisted image enhancement of a lateral X-ray of the skull (autopsy X-ray No. 2).



FIGURE 21.—Photograph of a pre-mortem lateral X-ray of the skull of President John F. Kennedy, against which to compare the damage shown in the autopsy X-rays Nos. 1 and 2.

#### 4. Autopsy Report

(304) The autopsy report localizes and characterizes the posterior head wound as follows:

Situated in the posterior scalp approximately 2.5 centimeters laterally to the right and slightly above the external occipital protuberance\* is a lacerated wound measuring 15 x 6 millimeters. In the underlying bone is a corresponding wound through the skull which exhibits beveling\* of the margins of the bone when viewed from the inner aspect of the skull. (34)

The "Autopsy Descriptive Sheet" shows a round circle overlying the occipital protuberance,\* with an arrow extending superiorly and to the left at approximately 11 o'clock and the notation "ragged, slanting, 15 by 6 millimeters." (See fig. 6.) Conspicuous by its absence is any descriptive legend which localizes this wound relative to body landmarks.

(305) Dr. Finck, in his correspondence to Brigadier General Blumberg, made this observation concerning the entrance wound:

I also noticed another scalp wound, possibly of entrance, in the right occipital region, lacerated and transversal, 15 by 6 millimeters. Corresponding to that wound, the skull shows a portion of a crater, the beveling\* of which is obvious on the internal aspect of the bone; on that basis, I told the prosecutors and Admiral Galloway that this occipital wound is a wound of entrance. (35)



(306) The panel was concerned about the apparent disparity between the localization of the wound in the photographs and X-rays and in the autopsy report, and sought to clarify this discrepancy by interviewing the three pathologists, Drs. Humes, Boswell, and Finck, and the radiologist, Dr. Ebersole. Each was asked individually to localize the wound of entrance within any one of several of the above-referenced photographs after reviewing the photographs, X-rays and autopsy report. In each instance, they identified the approximate location of the entrance wound on a human skull and within the photographs as being in a position perceived by the panel to be below that described in the autopsy report. (See figs. 22 and 23, photographs of a human skull.) They also said it coincided with the rectangular white material interpreted by the panel as brain tissue present on top of the hair near the hairline. Each physician persisted in this localization, notwithstanding the apparent discrepancy between that localization and the wound characterized by the panel members as a typical entrance wound in the more superior "cowlick" area.



FIGURE 22.—Photograph of the posterior view of a human skull on which the autopsy pathologists, Drs. Humes, Boswell, and Finck, identified the approximate location of the entrance wound. The two initialed circles on the lower portion of the skull and to the right of the midline represent the general area where the autopsy doctors believe the entrance wound to be. (There are two circles because Dr. Finck marked the skull independent of Drs. Humes and Boswell, and without knowing where Drs. Humes and Boswell had placed their circle.) The circle on the top portion of the skull and to the right of the midline represents the general area where the forensic pathology panel believes the entrance to be. (The fourth circle on the lower portion of the skull and approximately on the midline represents the location of the external occipital protuberance.)



FIGURE 23.—Photograph of the posterior-lateral view of the skull on which the autopsy pathologists identified the approximate location of the entrance wound. (See caption fig. 22.)

(307) Drs. Ebersole, Finck, and Boswell offered no explanation for the upper wound, while Dr. Humes first suggested that it might represent an extension of a more anterior scalp laceration, incident to the exit wound, in spite of the fact that within the photograph the margins of the wound appear to be intact around the entire circumference. Dr. Finck believed strongly that the observations of the autopsy pathologist were more valid than those of individuals who might subsequently examine photographs.

(308) The panel continued to be concerned about the persistent disparity between its findings and those of the autopsy pathologists and the rigid tenacity with which the prosecutors maintained that the entrance wound was at or near the external occipital protuberance.\* Subsequently, however, in his testimony before the select committee, Dr. Humes agreed that the defect was in fact in the “cowlick” area and not in the area of the brain tissue.

(309) The photographs of the brain, described later, also support the panel’s conclusions.

(310) One panel member, Dr. Rose, wishes to emphasize the view of the majority of the panel (all except Dr. Wecht) that the absence of injury on the inferior surface of the brain offers incontrovertible evidence that the wound in the President’s head is not in the location described in the autopsy report.

(311) All members of the panel except Dr. Wecht concur that there is one and only one wound of entrance in the head and that it is located

in the "cowlick" area of the back of the head, and that the white substance referred to by the original prosecutors is a fragment of brain tissue. Dr. Wecht agrees that there is an entrance wound in the "cowlick" area and that the white substance is brain tissue, but he cannot exclude the possibility that it might overlie a very small skin and bone perforation of either entrance or exit. (See fig. 13, a drawing of the back of the President's head, with the wound as previously identified by the panel. It shows the adherent white brain tissue and the localization of the entrance wound as described within the body of the pathologists' autopsy report and during recent interviews. See also fig. 24, a drawing of the posterior view of a human body depicting the location of the entrance wounds in the head and the upper back.)



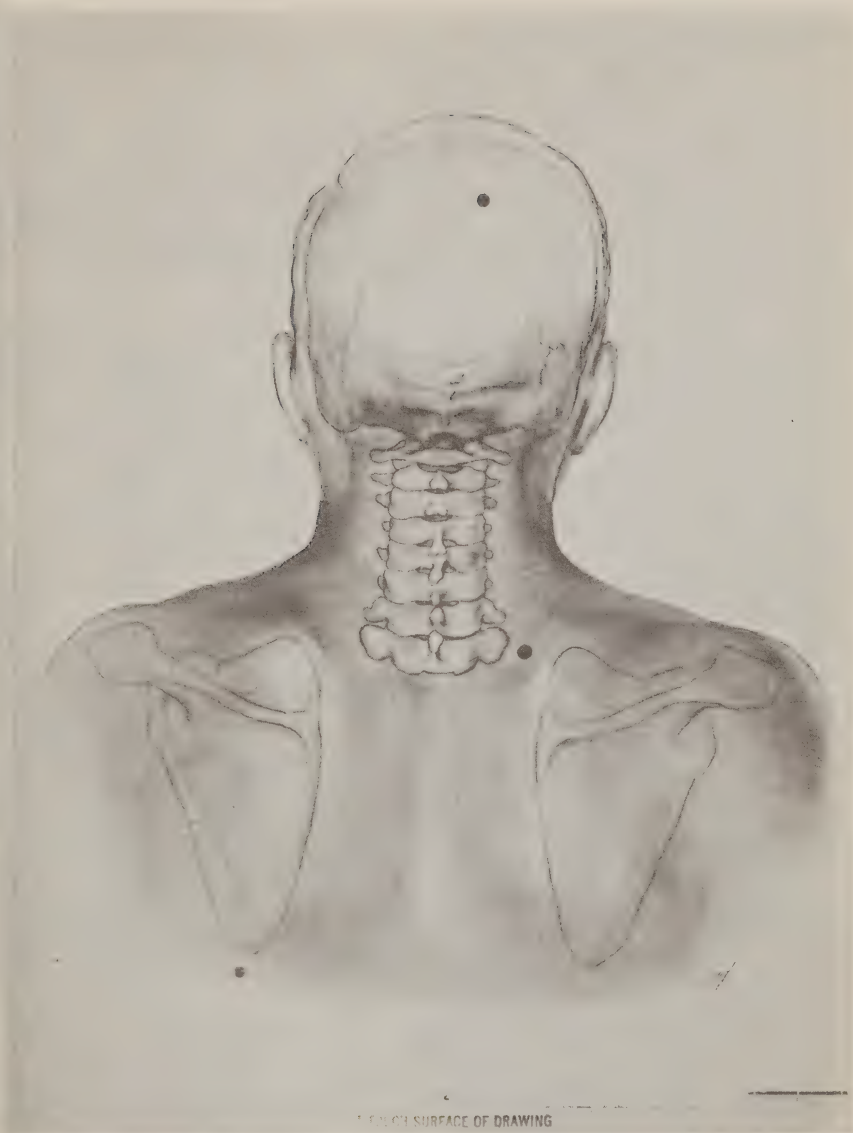


FIGURE 24.—A drawing of the posterior view of a human body depicting the location of the entrance wounds in the head and the upper back.

*Exit (outshoot) wound of the side of the head*

### 1. Photographs

(312) The panel examined photographs of the face and head of President Kennedy, taken from the front and to the right, including black and white prints No. 5 and 6 and color transparencies and prints Nos. 26, 27, and 28. These reveal a series of lacerations, described within the

autopsy report as extending from an area in the right parietal region, anteriorly to the right frontal region, to a point 1 to 2 centimeters below the hairline; inferiorly and to the right, almost to the upper border of the tragus\* of the ear; and posteriorly toward the occipital region and to the left across the midline. There is a large skin flap in the right frontal region anteriorly and laterally, with two fragments of an anterior compound fracture of the calvarium\* of the skull deflected outward and toward the right ear.

(313) The photographs also show brain substance within the margins of the skin and skull defect, similar to the white material adherent to the hair in the right occipito-parietal\* region described above.

(314) The panel also examined photographs taken from a position superior to the midportion of the President's head, including black and white prints Nos. 7, 8, 9, and 10 and color transparencies and prints Nos. 32, 33, 34, 35, 36, and 37. These reveal many of the features described in the preceding series of photos, including brain substance in the right temporoparietal\* region. A fragment of bone extends from the right frontotemporal\* region.

(315) Black and white photograph No. 17 and color transparency and print No. 44 are closeups of the margins of the fracture line in the right frontoparietal\* region after reflection of the scalp. On the margins of this fracture line is a semicircular defect which appears to be beveled\* outward, although the photograph is not in sharp focus. Computer-assisted image enhancement\* of this photograph revealed the defect more clearly. (See fig. 25, a closeup photograph of the semicircular exit defect on the margin of the fracture line in the right parietal region.)



FIGURE. 25.—Closeup photograph of the semicircular exit defect in the margin of the fracture fragment in the right parietal region.

(316) Anthropologist Dr. Angel's evaluation of the "Harper bone fragment" (see below) indicates that it may include a portion of the sagittal suture\* which is probably in apposition (corresponds) to this exit defect.



## 2. X-rays

(317) Left and right lateral skull X-rays Nos. 2 and 3, partly described above, when subjected to computer-assisted image enhancement,\* more clearly revealed the extent of the fractures of the temporoparietal\* region and their extensions into the fronto\* and occipital\* portions of the skull bilaterally. The displacement of the residual fracture fragments in the right temporoparietal region, with consequent overriding of several margins of the residual bony defect is also apparent. (See fig. 20.)

(318) Three additional X-rays, Nos. 4, 5, and 6, show three irregularly shaped pieces of skull recovered from within the President's limousine. The largest piece is almost triangular, with a serrated, or zigzag, edge on the longest straight margin, which the panel interprets as to be a portion of the right coronal suture.\* This edge meets a much sharper straight edge which represents an obvious fracture margin. At the junction of these two margins is a semicircular defect, described in the autopsy report as showing outward beveling,\* with small particles of radiopaque materials. These the panel considers to be missile fragments. (See fig. 26, an X-ray of the three bone fragments.)



FIGURE 26.—Photograph of an X-ray of the three bone fragments recovered from the limousine. These are depicted in X-ray films Nos. 4, 5, and 6. On the triangular fragment is the semicircular defect with outwardly beveled margins and radiopaque shadows which have the appearance of tiny missile fragments.

### *3. Autopsy Report*

(319) The autopsy report characterized the exit defect as follows:

1. There is a large irregular defect of the scalp and skull on the right involving chiefly the parietal bone,\* but extending somewhat into the temporal\* and occipital\* regions.

In this region there is an actual absence of scalp and bone producing a defect which measures approximately 13 centimeters in greatest diameter. From the irregular margins of the above scalp defect tears extend in stellate fashion into the more or less intact scalp as follows:

- a. From the right inferior temporoparietal\* region anterior to the right ear to a point slightly above the tragus.
- b. From the anterior parietal margin anteriorly on the forehead to approximately 4 centimeters above the right orbital ridge.\*
- c. From the left margin of the main defect across the midline antero-laterally, for a distance of approximately 8 centimeters.
- d. From the same starting point as 10 centimeters postero-laterally. (36)

(320) This description does little except locate the general area of convergence of the scalp lacerations. It is probably misleading in the sense that it describes "an actual absence of scalp and bone." The scalp was probably virtually all present, but torn and displaced; probably only the separately recovered bone fragments (described below) were absent. The description of the bone fails to recognize either the semi-circular defect or any beveling\* in the bone fragments still attached to the head.

(321) The note prepared by Dr. Finck for presentation to Brigadier General Blumberg, dated February 1, 1965, states, with respect to the exit wound:

No exit wound is identifiable at this time in the skull, but close to midnight, portions of cranial vault are received from Dallas, Tex. X-ray [sic] films of these bone specimens reveal numerous metallic fragments. Two of the bone specimens, 50 millimeters in diameter, reveal beveling\* when viewed from the external aspect, thus indicating a wound of exit. Most probably, these bone specimens are part of the very large right skull wound, 130 millimeter in diameter and mentioned above. This right fronto-parieto-occipital wound is therefore an exit. (37)

#### 4. "*Harper bone fragment*"

(322) The "Harper bone fragment" is a fragment of bone found near the scene of the assassination at 5:30 p.m. on November 23, 1963, by Billy A. Harper, then a premedical student. He was taking photographs of the assassination scene and, on finding the fragment, took it to his uncle, Jack C. Harper, M.D., who, in cooperation with A. B. Cairns, M.D., chief pathologist at the Methodist Hospital in Dallas, had photographs taken on November 25, 1963, by M. Wayne Balleter, chief medical photographer at that hospital. Two 35 millimeter color transparencies of the convex and concave surfaces of the fragment, with an inch ruler in place, were picked up from Mrs. Jack C. Harper on July 10, 1964, by Special Agent Robert P. Gemberling of the FBI. The panel examined both these photographs and 8- by 10-inch black and white and color prints prepared from them.



(323) Dr. J. Lawrence Angel, in a written memorandum addressed to the panel, dated October 24, 1977, characterized this fragment as follows (see addendum E for full text) :

The Harper fragment photographs show it as a roughly trapezoidal piece, 7 centimeters by 5.5 centimeters in size, coming mainly from the upper middle third of the right parietal\* bone. Near its short upper edge vascular foramina\* on the inside and a faint irregular line on the outside indicate saggital suture.\* Its posterior inferior pointed edge appears to fit the crack in the posterior section of the right parietal [bone] and its slightly wavy lower border can fit the upper edge of the loose lower section of right parietal [bone]. Its upper short border, on the left of the midline near vertex, may meet the left margin of the gap. Behind it there appears to be a large gap and in front a narrow one. (38)

(See figs. 27 and 28, photographs of both the interior and exterior surfaces of the "Harper bone fragment.")



FIGURE 27.—Photograph of the interior surface of the Harper bone fragment.

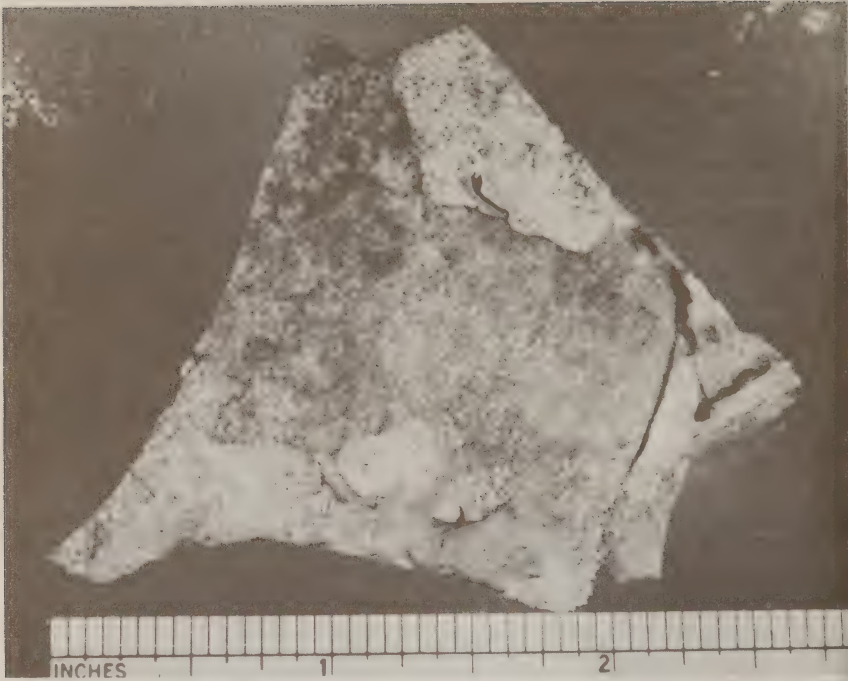


FIGURE 28.—Photograph of the exterior surface of the Harper bone fragment.

#### *5. Attempted reconstruction of the skull fractures*

(324) Paper cutouts were prepared to approximate the shape and size of the bone fragments demonstrated in X-rays Nos. 4, 5, and 6 and the photograph of the "Harper bone fragment." The panel attempted to locate the correct position of these fragments, and then, using the paper cutouts, to place these bone fragments on a human skull for the purposes of reconstruction. The largest of the X-ray fragments—that on which outer beveling and tiny metal fragments are evident—completes a portion of the exit perforation, with the suture line fitting into the coronal suture;\* the Harper bone fragment completes the circular perforation in the suture line immediately superior to the temporal\* bone. No other exit or entrance perforation is identified. (See fig. 29, a scale drawing of the frontal and right side of a human skull, which shows the displaced bone fragments and the extensive fragmentation of the skull.) The sagittal suture\* follows the midline in the anterior-posterior\* direction and is joined at approximately right angles by the coronal suture in front, which extends downward to the right and left sides, approximately midway between the outside margin of the orbit and the outer ear canal. (See also fig. 30, another scale drawing, showing the path of the bullet through the head, and fig. 31, a drawing of a profile view of President Kennedy, showing the internal anatomic structure and the location of the entrance and exit wounds to the head (the entrance wound is only partially visible).)

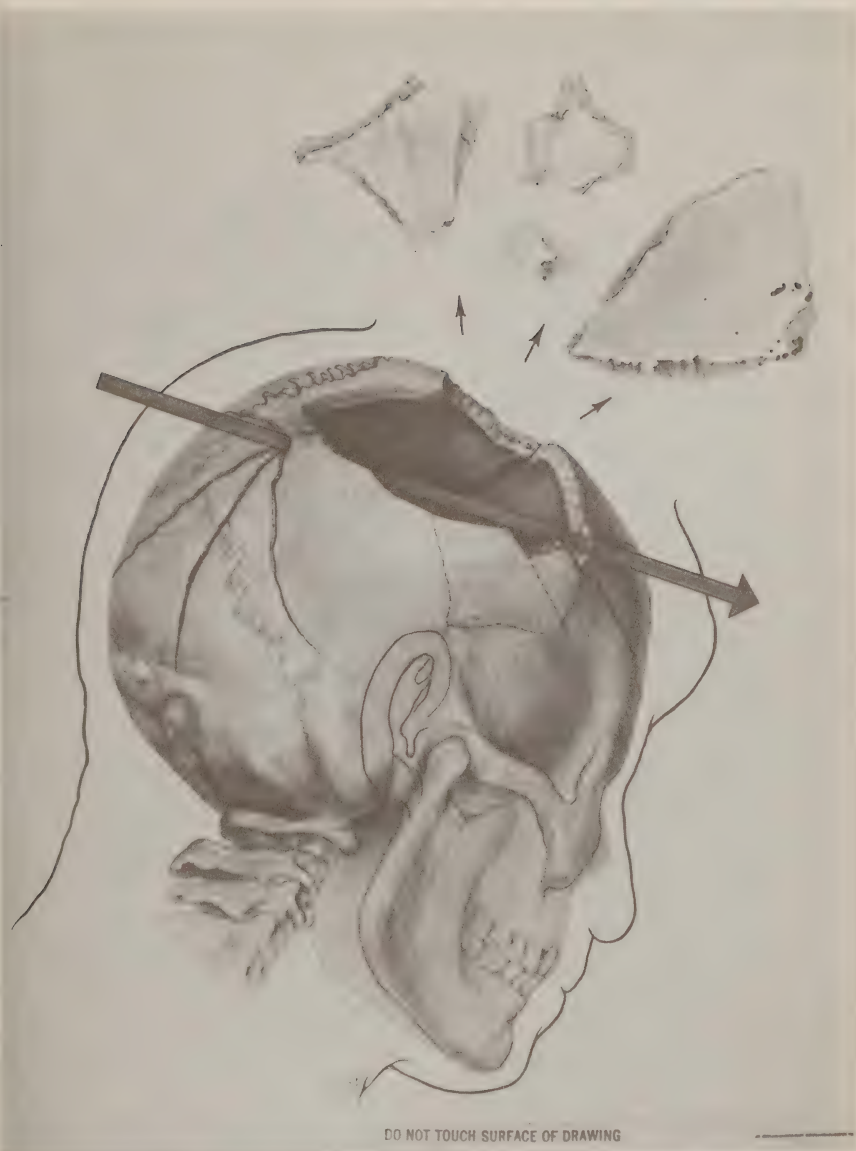


FIGURE 29.—Scale drawing of the frontal and right side of a human skull, which depicts the displaced bone fragments and the extensive fragmentation of the skull.



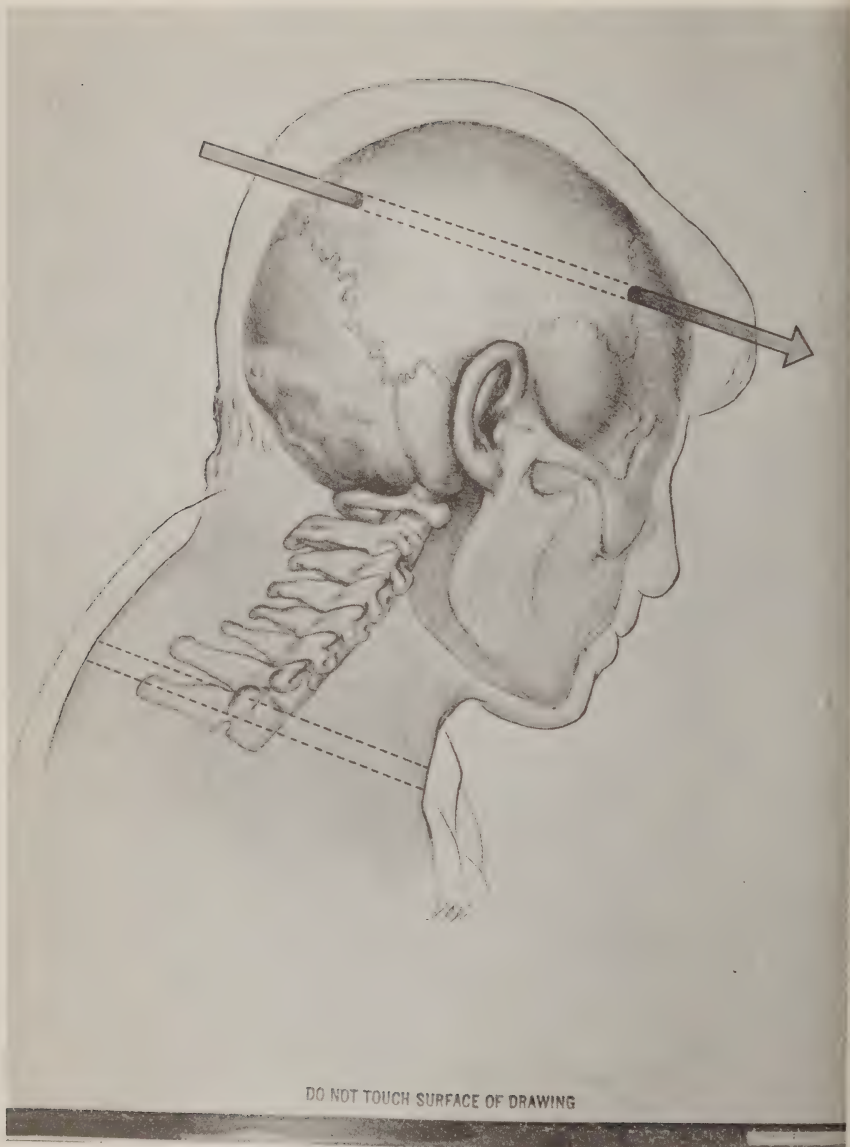
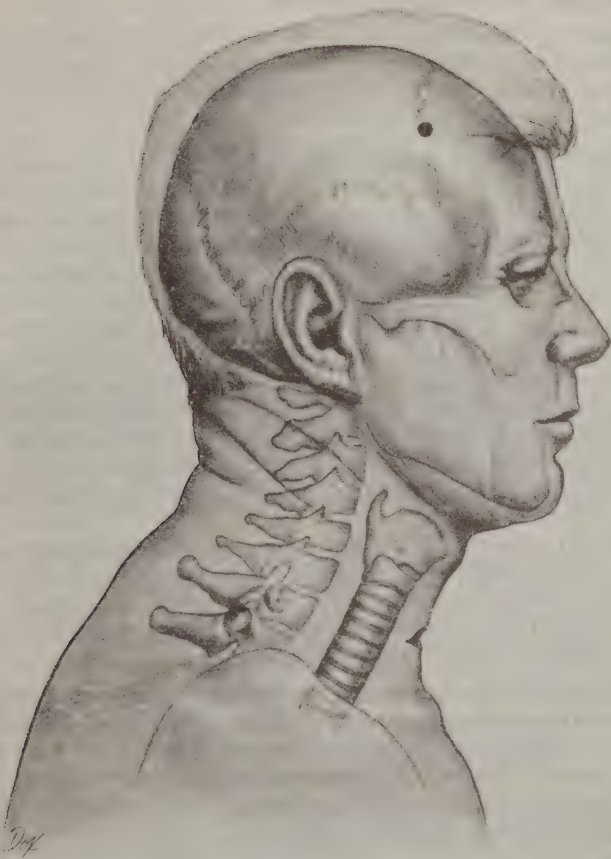


FIGURE 30.—Scale drawing which shows the path of the bullet through the head.



DO NOT TOUCH SURFACE OF DRAWING

FIGURE 31.—A drawing of a profile view of President Kennedy, showing the internal anatomic structures and the location of the entrance and exit wounds to the head (the entrance wound is only partially visible).

(325) The size of the exit defect is most accurately estimated from the X-rays of the largest separately received bone fragment, in which a segment of the circumference of the defect is demonstrated at one corner. Geometrically, by drawing a chord segment between the two extremities of this portion of the circumference and reconstructing

a perpendicular radius, the central extremity of which is equidistant from all portions of this curve, the diameter of the defect is estimated to be 2.5 centimeters. This is consistent with the size of the defect as seen in the photographs, but cannot be determined more precisely because no ruler was present in the same plane.

(326) According to Dr. Angel's report:

The two big loose fragments of skull vault, from upper frontal and parietal areas, more on the right than on the left side, do not articulate with each other and leave three appreciable gaps unfilled. (39)

Thus, the additional gaps may be accounted for by collapsed superimposed fragments of bone within the skull or there may still be fragments missing. Within one or several of these fragments, there might be an additional exit defect if the principal missile had divided into two major fragments within the skull, although in the experience of the members, the estimated size of the principal exit defect is consistent with the size of a single existing missile representing the mass of the two major fragments recovered outside the body.

(327) The panel considered and rejected the possibility that if there were a residual defect, it might conceivably have been the location for an additional entrance wound. It did so because there was no radiographic evidence of such a missile within the skull, nor any observation or description of the effects of such a missile either on the skin, on the skull bones or within the brain.

(328) One panel member, Dr. Wecht, suggests there is a remote possibility that a "soft-nosed" or frangible bullet could have struck the right side of the President's head in the exit defect leaving no visible evidence of a separate entrance wound. Further, according to Dr. Wecht in his dissent (which follows this report):

[s]ince this kind of ammunition would not have penetrated deeply into the brain, there would be no evidence of damage to the left cerebral hemisphere, nor would there be fragments of such a missile deposited in the left side of the brain. (40)

Dr. Wecht points out further that "there would not be a separate exit wound if this kind of ammunition had been used." (41)

(329) All other members of the panel believe that such speculation about the timing and placement of separate wounds is without merit, and, further, they know of no soft-nosed or frangible missile that would disintegrate so completely on striking a surface as soft as the brain. There is no evidence of any such disintegration in the X-rays.

### *Course of the missile through the head*

#### *1. Photographs*

(330) The panel examined photographs (including Nos. 17, 18, 44, and 45) they were taken from the front right side of the body, with the scalp reflected down and away from the fractured skull bones and with the brain removed. The lens was focused on the interior-posterior deepest portion of the wound, apparently in an attempt to depict the interior of the bullet perforation of the posterior region of the skull. In the photograph prepared from color transparency No. 45, the ex-



terior bone fragment with the semicircular defect is more in focus than the base of the skull in the depth of the picture which is out of focus. In the photographs prepared from positive color transparency No. 45, the exterior fragment is out of focus, but the depth of the photograph is in sharper focus. The photographs, also studied using the computer-assisted enhancement technique,\* show a possible portion of the beveled\* inner table corresponding to the semicircular margin of the entrance wound at the back of the head in the right posterior parietal bone. Color transparencies and prints Nos. 46, 47, 48, and 49 and black and white prints Nos. 19, 21, and 22 reveal the inferior aspect of the brain, with extensive fragmentation and laceration of the right inferior cerebral hemisphere, some loss of cerebral substance on the inferior surface of the left temporal lobe,\* and scattered areas of subarachnoid hemorrhage\* in the underlying cortex.\* The right Sylvian fissure\* shows dark red-brown to black discoloration suggestive of blood clot. The surface of the midtemporal region is lacerated and depressed. The cerebral peduncles\* are likewise lacerated. The panel notes that the posterior-inferior portion of the cerebellum\* virtually intact. It certainly does not demonstrate the degree of laceration, fragmentation, or contusion\* (as appears subsequently on the superior aspect of the brain) that would be expected in this location if the bullet wound of entrance were as described in the autopsy report. There is no damage in the area of the brain corresponding to the piece of brain issue on the hair which the autopsy pathologists told the panel was the entrance wound.

331) The panel examined the photographs of the superior aspect of the brain, including color transparencies and prints No. 50, No. 51 and No. 52 and black and white prints No. 20, No. 23, No. 24 and No. 25. The left cerebral hemisphere is covered by intact arachnoid\* beneath which dark brown to black subarachnoid hemorrhage\* is most prominent over the frontal and parietal gyri\* and within the adjacent sulci.\* On the right cerebral hemisphere is an anterior-posterior cylindrical groove in which the brain substance is fragmented or absent. This groove extends from the back of the brain to the right frontal area of the brain and contains within the depths of its central portion a grey-brown rectangular area. The majority of the panel considers this to be a blood vessel in the Sylvian fissure.\*

332) The majority of the panel members agrees that examination of the brain itself even now would substantiate this opinion. One member, Dr. Wecht, can justify no such opinion without first examining the brain itself.

333) Laceration of the corpus callosum within the deep margins of the wound of the right cortex is also evident (see fig. 32, a drawing of the superior surface of the brain).

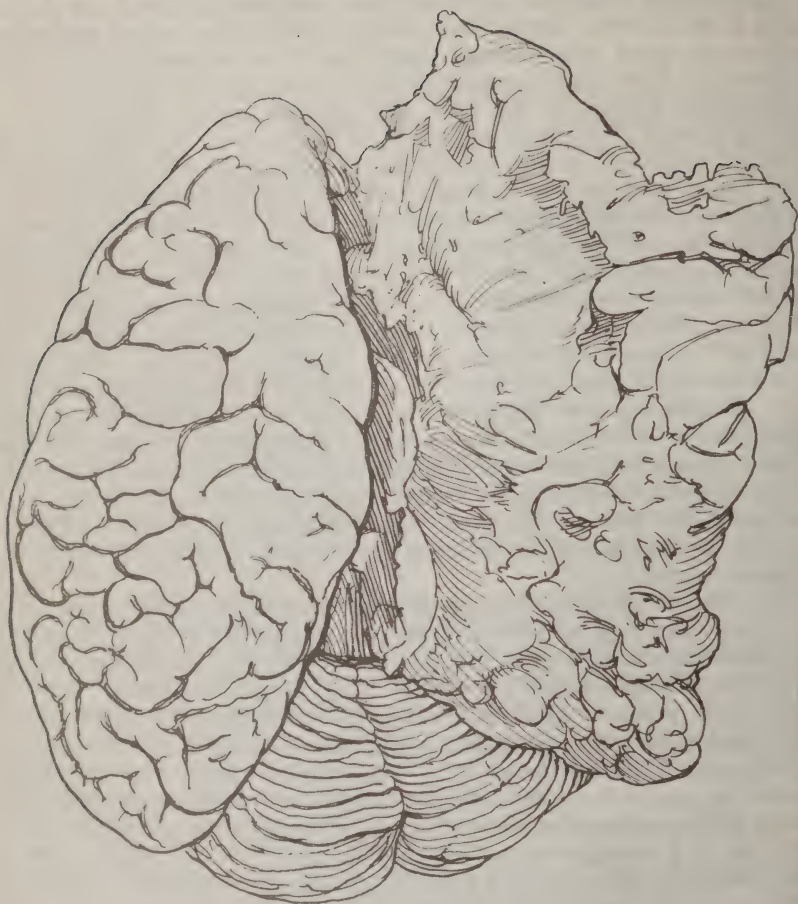


FIGURE 32.—Drawing of the superior surface of the brain, showing the extensive lacerations.

## 2. X-rays

(334) The panel examined X-ray films of the anterior-posterior view of the skull (No. 1) and left (No. 2), and right (No. 3) lateral views of the skull with the naked eye and with  $10\times$  magnification. Film No. 2 reveals the defect referred to above in the posterior parietal region,\* in a location corresponding to the previously described skin defect in the "cowlick" area of the scalp. Embedded in the skull in the lower

margin of this defect is a radiopaque shadow which, in the opinion of the panel, is a fragment of the missile. This shadow is 10 centimeters above the external occipital protuberance and 2.5 centimeters to the right of the midline in this film. One surface of this fragment, visualized in film No. 1, is round. The maximum diameter of the fragment measures 0.65 centimeter.

(335) Within the right side of the head are randomly distributed, irregularly shaped, radiopaque shadows which are missile fragments. These shadows, measuring from 0.2 to 0.6 centimeter in diameter, extend from the back to the front; the largest one is present beneath the skin in front. Another group of smaller, more uniform shadows, 0.1 centimeter or less in diameter, so-called "missile dust,"\* forms a cylindrical pattern, with the axis directed anterior-posterior,\* approximately paralleling the sagittal plane,\* and extending toward the large bony defect in the right temporal-parietal\* region on the right side of the head. The long axis of this grouping, if extended backward, approaches the entrance defect and missile fragment in the right side of the back of the head.

(336) The panel considered the location and grouping of the smaller missile fragments seen in films Nos. 2 and 3 and suggests that the extensive fragmentation and disruption of the skull bones, and the movement of the body after death, could have caused movement of the missile fragments in movable portions of skin, bone, and brain. The panel also noted the absence of any metal fragment within the left cerebral hemisphere, as demonstrated in film No. 1, although a number of extensive fractures involving the upper portion and base of the right skull extend across the midline.

(337) The panel also noted several artificially caused defects on these films. Two round, puckered areas on film No. 1 were apparently due to examination under a high intensity light that was too close. Dr. Ebersole advised the panel that he placed the converging pencil lines on film No. 2 after the autopsy, pursuant to an official White House request to obtain certain anthropometric measurements for a sculptor. None of these defects interfered with accurate interpretation of these films.

(338) In March 1978, Dr. McDonnell of Los Angeles, examined the skull films for the panel and reported:

My preliminary (prior to analysis of computer-assisted enhanced images of these X-rays) interpretation follow (sic):

1. A nearly complete loss of structure in the right frontal and parietal bone.
2. A metallic fragment on the outer table of the right occipital bone approximately 10 centimeters above the external occipital protuberance. In the same area is a depressed fracture. In the anterior-posterior projection, there appears to be fracture lines to the occipital, parietal and temporal bone, radiating from the area of the fracture and metallic fragments. The metallic fragment is nearly spherical in this projection.
3. There is elevation of the galea\* medial and lateral to the area of the fracture and metallic fragment in the occipital region. A small metallic fragment is located



medial to the location of the spherical metallic fragment and fracture between the galea lying and the outer cranial table.

4. There is a fracture line through the floor of the sella turcica\* with bony fragments in the sphenoid sinus.\*
5. There are fracture lines through the anterior and posterior aspects of the anterior ethmoid\* cells with air in the right side anterior ethmoid. (42)

(339) Dr. McDonnel further examined these films using computer-assisted enhancements\* of the anterior-posterior\* (fig. 19) and left lateral (fig. 20) views and submitted a more detailed report on August 4, 1978. Such separation of the galea\* from the outer skull bones often occurs as a result of the dislocation of adjacent bone fragments and is seen in an explosive-type injury to the skull. The location of the metallic fragment inside the galea\*, medial to the defect in the skull representing the initial penetration, suggests that this separation commenced on initial impact, allowing the tiny above-described missile fragment to be displaced medially within this space created by explosion (between the skull and its overlying galea). Dr. McDonnel also indicated that such dislocation of this and other missile fragments might have occurred as a consequence of manipulation of the head prior to, during or following transit, but prior to the X-ray examination of the skull, although such medial dislocation would not be expected as a consequence of gravity alone.

(340) Dr. Chase, during his examination, noted the presence of extensive comminuted fractures of the calvarium.\* He said that the extensive damage apparent from the X-ray precluded interpretation of exactly what happened to the top of the skull, based on radiographic examination alone. He indicated that he saw no evidence of any posterior missile perforation apart from one in the posterior parietal area. Stated more explicitly, there was no perforation in the area of the external occipital protuberance.\* He further indicated that the degree of damage to the skull and the fact that there was "little residual material" (relatively small amount of bullet fragments present) led him to believe that the missile was jacketed.\* He said further that there was no evidence in the X-rays of a shot coming from the front or of more than one bullet striking the skull. Dr. Chase indicated that for there to be a second entrance perforation, there would have to be another exit point in the skull or a bullet that was left behind, neither of which is present.

(341) Dr. Davis described the entrance wound visible in the X-rays as follows:

There is an extensive comminuted, open, explosive calvarial fracture which seems to radiate in various directions as described above from a central point which is located in the right parietal bone, 3 centimeters from the midline and about 9 or 10 centimeters from the external occipital protuberance.\* (43)

(342) The panel understands the vertical distance mentioned above to mean 9 or 10 centimeters above the horizontal plane through the external occipital protuberance.\*

### 3. Autopsy report

(343) The autopsy report describes the track of the missile through the head as follows:

Clearly visible in the above described large skull defect and exuding from it is lacerated brain tissue which on close inspection proves to represent the major portion of the right cerebral hemisphere. At this point it is noted that the falx cerebri\* is extensively lacerated with disruption of the superior sagittal sinus.

Upon reflecting the scalp, multiple complete fracture lines are seen to radiate from both the large defect at the vertex and the smaller wound at the occiput. These vary greatly in length and direction, the longest measuring approximately 19 centimeters. These result in the production of numerous fragments which vary in size from a few millimeters to 10 centimeters in greatest diameter.

The complexity of these fractures and the fragments thus produced tax satisfactory verbal description and are better appreciated in photographs and roentgenograms\* which are prepared. (44)

(344) The panel acknowledges the difficulty of and necessity for describing the fractures and suggests that the autopsy examination at the very least should have noted evidence in the skull and scalp that would assist in localizing the exit wound. An appropriate examination would have included replacement of the bone fragments in approximate anatomic position and then description of the missile track from the entrance to the exit wound.

(345) The autopsy report states that: "The brain is removed and preserved for further study following formalin fixation." (45) The brain, which had been fixed in formalin, the chemical preservative normally used to prevent deterioration, was further examined. The results are described in the "Supplementary Report of Autopsy No. A63-272, President John F. Kennedy" (Commission Exhibit No. 391). This document observes:

Following formalin fixation the brain weighs 1500 grams. The right cerebral hemisphere is found to be markedly disrupted. There is longitudinal laceration of the right hemisphere which is a parasagittal in position approximately 2.5 centimeters to the right of the midline which extends from the tip of the occipital lobe\* posteriorly to the tip of the frontal lobe\* anteriorly. The base of the laceration is situated approximately 4.5 centimeters below the vertex\* in the white matter. There is considerable loss of cortical\* substance above the base of the laceration, particularly in the parietal lobe. The margins of this laceration are at all points jagged and irregular, with additional lacerations extending in varying directions and for varying distances from the main laceration. In addition, there is a laceration of the corpus callosum\* extending from the genu to the tail. Exposed in this latter laceration are the interiors of the right lateral and third ventricles.\*

When viewed from the vertex the left cerebral hemisphere is intact. There is marked engorgement of meningeal blood vessels of the left temporal and frontal regions with considerable associated subarachnoid hemorrhage.\* The gyri\* sulci\* over the left hemisphere are of essentially normal size and distribution. Those on the right are too fragmented and distorted for satisfactory description.

When viewed from the basilar aspect\* the disruption of the right cortex is again obvious. There is a longitudinal laceration of the midbrain through the floor of the third ventricle\* just behind the optic chiasm and mammillary bodies. This laceration partially communicates with an oblique 1.5 centimeter tear through the left cerebral peduncle.\* There are irregular superficial lacerations over the basilar aspects of the left temporal and frontal lobes. (46)

(346) The panel notes that the brain was not coronally sectioned, a standard pathological practice which permits examination of the inside of the brain. Rather, as evidenced in the autopsy report, supplemental report and Dr. Humes' testimony before the Warren Commission, (47) the brain was preserved intact without a complete examination. Only very limited microscopic sections were taken. The panel stresses that coronal sectioning\* is the most acceptable and accurate method of determining precisely the effects of a missile on the brain, as well as the angle of a bullet track in the head. The failure to section the brain also precluded collection of interior samples for microscopic study.

(347) The panel members do not concur with the rationale for having limited the examination in this way. The brain should have been scientifically examined, with sectioning and description of the interior injuries. Only those portions necessary to document the findings need have been retained as evidence for potential court proceedings or for other purposes.

(348) The autopsy report lists the outer brain areas from which sections were taken for microscopic examination:

- a. From the margin of the laceration in the right parietal lobe.\*
- b. From the margin of the laceration in the corpus callosum.\*
- c. From the anterior portion of the laceration in the right frontal lobe.\*
- d. From the contused left fronto-parietal cortex.\*
- e. From the line of transection of the spinal cord.
- f. From the right cerebellar cortex.\*
- g. From the superficial laceration of the basilar aspect of the left temporal lobe.\* (48)

(349) These sections are described as follows:

*Microscopic examination*—Brain.—Multiple sections from representative areas as noted above are examined. All sections examined are there significant abnormalities other brain tissue with associated hemorrhage. In none of the sections examined are there significant abnormalities other than those directly related to the recent trauma. (49)



(350) The summary within the autopsy report contains this statement concerning the missile pathway:

The fatal missile entered the skull above and to the right of the external occipital protuberance.\* A portion of the projectile transversed the cranial cavity in a posterior-anterior direction (see lateral skull roentgenogram) depositing minute particles along its path. A portion of the projectile made its exit through the parietal bone on the right carrying with it portions of cerebrum, skull and scalp. The two wounds of the skull combined with the force of the missile produced extensive fragmentation of the skull, laceration of the superior sagittal sinus, and of the right cerebral hemisphere. (50)

(351) The summary concludes:

In addition, it is our opinion that the wound of the skull produced such extensive damage to the brain as to preclude the possibility of the deceased surviving this injury.

(352) The panel concurs with this opinion.

(353) Dr. Finck, in his personal note to Brigadier General Blumberg dated February 1, 1965, added this additional information on the observation of the head wound:

The scalp of the vertex\* is lacerated. There is an open comminuted fracture of the cranial vault, many portions of which are missing. The autopsy had been in progress for 30 minutes when I arrived. Commander Humes told me that he only had to prolong the lacerations of the scalp before removing the brain. No sawing of the skull was necessary. The opening of the large head wound, in the right fronto-parieto-occipital region, is 130 millimeters in diameter. (51)

#### *Other Autopsy considerations*

##### *1. Other wounds*

(354) With the exception of Dr. Wecht, as noted earlier, the panel, having viewed all of the photographs, X-rays and other documentary information concerning the autopsy on President Kennedy, concurs that there is evidence of two, and only two, gunshot wounds, and that they both entered from behind. The panel notes that the autopsy pathologist did not know that the tracheotomy incision had been made through a bullet wound in the front of the neck until sometime after the autopsy and removal of the body from Bethesda Naval Hospital. They did indicate the other wounds on the body which resulted from surgical treatment. These were recorded in the autopsy report prepared by Drs. Humes, Finck and Boswell as follows:

Situated on the anterior chest wall in the nipple line are bilateral 2 centimeters long recent transverse surgical incisions into the subcutaneous tissue. The one on the left is situated 11 centimeters cephalad to the nipple and the one on the right 8 centimeters cephalad to the nipple. There is no hemorrhage or ecchymosis associated with these wounds. A similar clean wound measuring 2 centimeters in length is situated on the anterolateral aspect of the left mid arm. Situated on the

anterolateral aspect of each ankle is a recent 2 centimeters transverse incision into the subcutaneous tissue. (52)

(355) The panel also took note of a summary of the findings, prepared by the three original pathologists, at the time of their review of the photographs and X-rays on November 1, 1966, and signed on January 26, 1967. The following is from that document :

*No other wounds.*—The X-ray films established that there were small metallic fragments in the head. However, careful examination at the autopsy, and the photographs and X-rays taken during the autopsy, revealed no evidence of a bullet or of a major portion of a bullet in the body of the President and revealed no evidence of any missile wounds other than those described above. (53)

(356) The panel concurs with these observations.

## 2. *Examination of the Abdominal Organs*

(357) The panel took note of the observations recorded within the autopsy report prepared by the three pathologists in which the gross description\* is limited to the following statement :

*Abdominal Cavity.*—The abdominal organs are in their normal positions and relationships and there is no increase in free peritoneal fluid. The vermiform appendix is surgically absent and there are a few adhesions joining the region of the cecum\* to the ventral abdominal wall at the above described old abdominal incisional scar. (54)

(358) Microscopic examination of the abdominal organs was limited to the liver, spleen, and kidneys, described as follows :

*Liver.*—Sections show the normal hepatic architecture to be well preserved. The parenchymal cells exhibit markedly granular cytoplasm indicating high glycogen content which is characteristic of the "liver biopsy pattern" of sudden death.

*Spleen.*—Sections show no significant abnormalities.

*Kidneys.*—Sections show no significant abnormalities aside from dilatation and engorgement of blood vessels of all calibers. (55)

(359) The panel is concerned that the Autopsy Protocol and Supplemental Report do not include reference to, nor description of, the President's other organs, including the adrenal glands. The panel took note of several publications in the medical literature relevant to his adrenal glands :

1. Nichols, John, M.D., "President Kennedy's Adrenals," *Journal of the American Medical Association*, July 10, 1967, vol. 201, No. 2, pp. 115-116.
2. Nicholas, James A., M.D., Philip D. Wilson, M.D., and Charles J. Umberger, Ph. D., "Induced Hypoadrenalism in Patients Requiring Orthopedic Surgery," *Journal of the American Medical Association*, May 18, 1957, vol. 164, No. 3, pp. 261-265.
3. Nicholas, James A., M.D., Charles L. Burstein, M.D., Charles J. Umberger, Ph. D., and Philip D. Wilson, M.D., "Management of Adrenal Cortical Insufficiency During Surgery," *Archives of Surgery*, vol. 771, 1955, p. 737.

(360) The 1967 article persuasively presents correlation for the dates listed in the 1955 and 1957 articles, when then-Senator John Kennedy underwent spine surgery, specifically lumbar fusion, at a New York hospital, and describes the successful medical management of his hypoadrenalism (Addison's disease). Although Senator Kennedy's name is not mentioned in these reports, the majority of the panel is convinced that he could still definitely be identified, substantially earlier contentions that he did suffer from hypoadrenalism. That he suffered from this condition is further supported by the fact that the President's physician provided the attending surgeons at Parkland Hospital with steroids. The gunshot injuries clearly were fatal, however, and would have been fatal independent of the condition of his adrenal glands.

(361) Pathologists in courts of law are usually asked to provide evidence concerning the condition of organs other than those directly concerned with the immediate cause of death. All of the panel members are of the opinion that a medicolegal autopsy report should be complete, whether or not it is ultimately available to the public. In support of this position, the panel suggests that, were the injuries inflicted upon the President of such a nature that a preexisting disease might alter the prognosis, observations about such a condition would be essential to evaluating properly the interrelationship of the preexisting natural disease and the terminal injuries. The panel believes the autopsy should be complete, even though in many jurisdictions in the United States all of the information derived as a result of examination at public expense pursuant to statute may be made public on presentation of a request with reasonable cause.

### *3. Organs and histologic sections*

(362) All members of the panel acknowledge that, as a rule, when reviewing another pathologist's work, they should have access to all pertinent materials, including written reports, histologic slides, and any tissues or other evidence which was retained. In this instance, since no descriptions, photographs, or microscopic slides were available to document the condition of the inside of the brain, and since injuries to the brain were critical in evaluation aspects of the President's death, the panel urged to committee to search for the missing histologic slides, tissues, and the brain itself. The majority of the panel (all except Dr. Wecht) believes that a most reasonable and diligent search was undertaken at considerable expense and effort by the committee and that the missing materials are not available. The majority of the panel further believes that the documentation that is available—photographs of the body and the uncut brain, X-rays, and autopsy and physician reports—are sufficient to permit accurate evaluation of the gunshot injury to the head and brain, and that proper examination of the brain itself would only further confirm the panel's conclusion that one, and only one, bullet struck the President's head from behind. The panel believes that all of the histologic sections should also be reviewed, but that such review would not alter its conclusions, which are based on the extensive gross injuries described and documented and on the microscopic report available.



## DESCRIPTION OF GOVERNOR CONNALLY'S WOUNDS

(363) Governor Connally sustained an entrance wound in the right lateral back, with a corresponding exit wound on the right front chest below the right nipple; a reentry wound on the dorsum (back or top) of the right wrist, with a corresponding outshoot wound on the volar (palmar or lower surface) of the right wrist; and a superficial entrance wound in the left thigh. Documentation of these wounds is as follows:

*Entrance (inshoot) wound of the right lateral back (thorax)*

*1. Clothing—suit jacket (back)*

(364) The suit is of lightweight, black, closely woven fabric; the jacket is three-buttoned, single-breasted, size 42 tall. There is an irregularly shaped oval defect perforating all layers of the jacket on the right back, with its midpoint 19.5 centimeters to the right of the midline and 13.6 centimeters below the upper shoulder-seam, measuring approximately 1.7 by 1.2 centimeters. (See fig. 33, a photograph of the back of Governor Connally's jacket.) Further characterization of this and other defects in Governor Connally's clothing was not undertaken prior to the garments being cleaned. (The Connally clothing was cleaned, presumably to make it more presentable, before any members of the original investigative team determined that scientific examination might be of value.) There was never any attempt to preserve the chain of custody of this evidence, an essential procedure if it were to be used in a subsequent criminal proceeding.



FIGURE 33.—Photograph of the back of Governor Connally's suit jacket, showing the posterior entry hole.

(365) This situation is explained in correspondence from Hoover to Rankin, dated April 16, 1964:

Reference is made to your letter dated April 9, 1964, covering transmittal to the FBI laboratory of Gov. John Connally's coat, shirt, trousers and tie, and requesting an examination of these items. The results of the examination are set forth below.

For your information the coat has been designated C311, the trousers C312, the shirt C313, and the tie C314.

Nothing was found to indicate which holes were entrances and which holes were exits. The coat, shirt and trousers were cleaned prior to their receipt in the laboratory, which might account for the fact that no foreign deposits of metal or other substances were found on the cloth surrounding the holes. Further, no characteristic position of the fibers of the cloth around the holes, which is one of the factors considered in determining whether a hole is an entrance or an exit hole, was found. The sizes of the holes in the clothing do not necessarily aid in this determination, since a hole can be enlarged if the bullet strikes at an angle, sideways or partially sideways, or if it passes through a fold in the cloth. Also, if a bullet is irregularly mutilated, an entrance hole could be larger than an exit hole.

It was not possible from an examination of the clothing to determine whether or not all of the holes were made by the same projectile or projectile fragments. (56)

(366) The panel suggested that appropriate areas of Governor Connally's clothing, including the area of the jacket around the back entrance defect and corresponding exit and reentry defects elsewhere on the clothing, be subjected to two types of analysis: Soft X-ray\* and energy dispersive X-ray\* examination. The purpose would be primarily to determine if any missile particles remained on the clothing, to analyze and define the elemental nature of such fragments, and, finally, to determine if any correlation might be made between the elements found and the missile's behavior after striking Governor Connally.

(367) The analysis was conducted at the Southwest Institute for Forensic Sciences in Dallas, Tex. (a copy of the complete report is found in addendum F). It contains the following discussion on the defects in Governor Connally's clothing:

In regard the J.B.C.'s clothing: It should be noted that the clothing had been subjected to dry cleaning at some time after the shootings. The validity of the results may therefore be questioned.

One aberrant result, unexplained, possibly due to a misrecording of data or a temporary malfunction of the instrument (EDX) or perhaps an ephemeral contamination, was encountered. Reanalysis of the questioned area proved the aberrance. Copper was found in quantity in the region of the defect in the right front. The results would indicate that the apparent borderline copper analysis is due to the lining containing some copper. Iron, apparently from blood, was still detectable near the right front defect in the coat, despite dry cleaning.

The analytical results are of interest, because there is proof of very little fragmentation of the missile (missiles) as it (they) passed through the person(s) of J.F.K. and J.B.C. Indeed, the only indication of copper in any quantity was in the region of the front defect of the coat of J.B.C. The term "in quantity" means only that copper was found in clearly detectable amounts by the use of the EDX [energy-



dispersive X-ray] equipment. The actual amount is very small, and the absence of particulate material on the SC [soft X-ray] film is not surprising. (57)

*2. Clothing—Shirt (back)*

(368) The shirt is long-sleeved, French-cuffed, white dress, size 16-35. A defect in the back measuring up to 0.8 centimeter in vertical diameter and 1.3 centimeters in transverse diameter is in a position corresponding to the defect in the jacket, with its upper margin 12 centimeters below the shoulder seam and 5 centimeters medial to the right shoulder seam (See fig. 34, a photograph of the back of Governor Connally's shirt )



FIGURE 34.—Photograph of the back of Governor Connally's shirt.

### 3. *Surgical report and interview with the surgeon*

(369) Dr. Robert Shaw's operative record characterizes the posterior wound of entrance as follows:

It was found that the wound of entrance was just lateral to the right scapula close [to] the axilla yet had passed through the latysmus [latissimus] dorsi muscle \* \* \* the wound of entrance was approximately three centimeters in its longest diameter \* \* \* (58)

(370) A report on a committee interview with Dr. Shaw included the following:

The rear entrance wound was not 3 centimeters [in diameter] as indicated in one of the operative notes. It was a puncture-type wound, as if a bullet had struck the body at a slight declination [i.e., not at a right angle]. The wound was actually approximately 1.5 centimeters in diameter. The ragged edges of the wound were surgically cut away, effectively enlarging it to approximately 3 centimeters. (59)

(371) Shaw also said in the interview that this wound was shaped as if the bullet had entered at a slight declination. Shaw probed through this wound with his finger and felt the Penrose drain that he had placed in the latissimus dorsi muscle.\*

(372) In measuring the diagram, made by Dr. Shaw at the time of the staff interview in order to illustrate better the size of the entrance and exist wounds, it is interesting that the entrance wound measurements taken from this diagram are 1.5 by 0.8 centimeters, with the long dimension in the longitudinal plane of the body (the long axis), and that the exit wound is approximately 5 centimeters in greatest dimension. (See fig. 35, a drawing prepared during the interview in which Dr. Shaw attempted to convey the actual size and location of both the entrance wound in the right posterior thorax and the corresponding exit in the right anterior thorax.)

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AT DALLAS

Name \_\_\_\_\_ Autopsy No. \_\_\_\_\_

Color \_\_\_\_\_ Age \_\_\_\_\_ Date \_\_\_\_\_

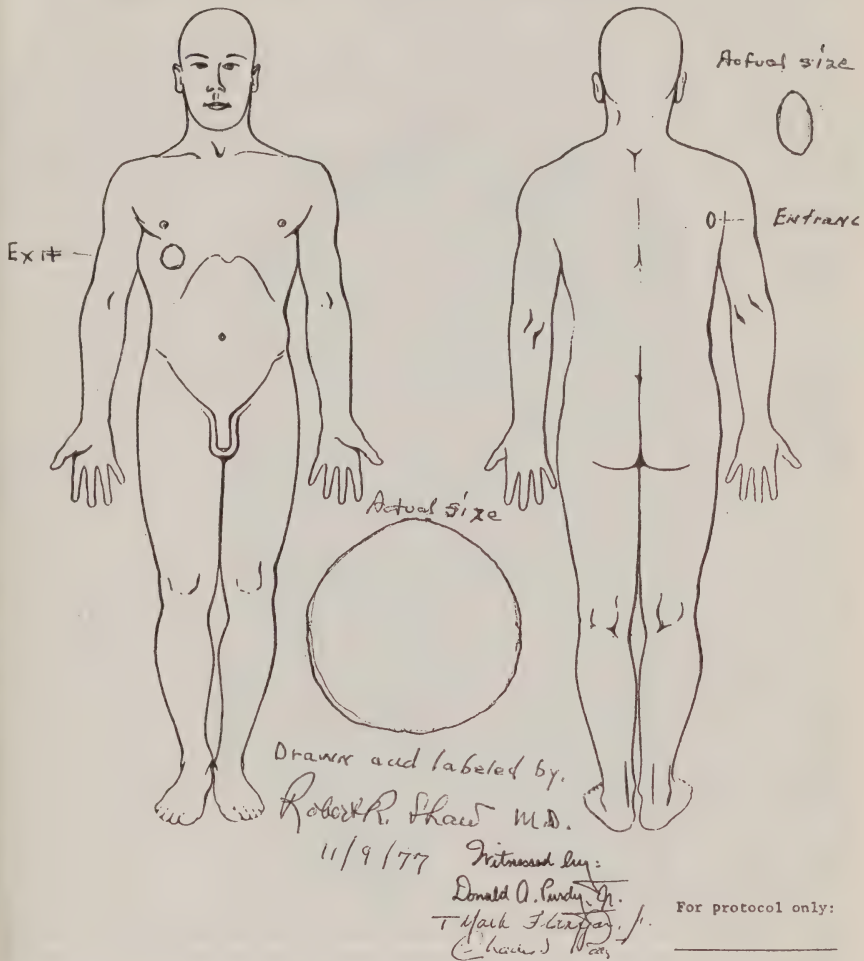


FIGURE 35—Reproduction of a drawing prepared during a staff interview with Dr. Robert R. Shaw, in which Dr. Shaw attempted to convey the actual size and location of both the entrance hole in the posterior thorax and the corresponding exit in the right anterior thorax.

(373) In September 1978, Dr. Baden conducted a physical examination on Governor Connally to see the scars resulting from his wounds (see addendum G for the complete report on this examination). Dr. Baden localized these wounds as follows:

[A]t the site of gunshot perforation of the right upper back there is now a  $1\frac{1}{8}$  inches long horizontal pale, well



healed scar that is up to three-eighths inch wide centrally, with a lateral border slightly lower than the medial border (about 5 inches). The medial margin is one-half inch superior to and five-eighths inch medial to the apex of the right posterior axilla. The lateral border is 6 inches to the right of the midline of the back and  $4\frac{3}{4}$  inches below the shoulder line. (60)

(374) The panel believes that the ovoid characterization of this wound requires interpretation. The examination of the clothing, had it been conducted immediately after the wounding, might have been of assistance. One possible interpretation is that the ovoid entrance wound, as described, could have resulted from the missile striking the skin surface on a tangential plane, causing an abrasion most pronounced on the margin adjacent to the acute angle of the trajectory that would create the illusion that the wound was more ovoid than it actually was. The undermining of the contralateral margin, when the wound itself is looked into, would accentuate the out-of-round character of the wound in itself. Dr. Shaw, in his original description and subsequent interview, did not note any significant undermining or abrasion by the missile which would have been produced by a non-tumbling,\* tangential impact.

(375) Another possible interpretation of this ovoid wound is that the missile itself, just prior to striking the body, was out of alinement with its trajectory (due to striking an intervening object). That is to say, it had tumbled\* slightly before entering the body, thereby creating an elongated defect.

(376) The panel, in its evaluation, also considers it important that the shape of the defect in the clothing would have been a more uniformly round hole if the bullet had struck on a tangential plane with the missile alined with its trajectory. The panel (except for Dr. Wecht) concludes, therefore, that the wound in Governor Connally was probably inflicted by a missile which was not alined with its trajectory but had yawed\* or tumbled\* prior to entry into the Governor. This conclusion incorporates consideration of the testimony of relatively inexperienced, somewhat hurried observers, not fully aware of the subsequent implications of their findings.

*Exit (outshoot) wound of the right anterior chest*

#### *1. Clothing—Suit jacket (front)*

(377) There is an irregularly round defect, measuring 1 by 1 centimeters in maximum diameter, penetrating all layers of the coat on its right front side. The midpoint of the defect in the jacket is 34.5 centimeters below the upper border of the collar, 49 centimeters above the lower margin of the coat, and 15 centimeters to the right of the midline. (See fig. 36, a photograph of the front of Governor Connally's coat, illustrating the location of the anterior exit bullet hole.)

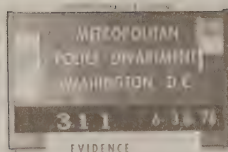


FIGURE 36.—Photograph of the front of Governor Connally's suit jacket, showing the location of the anterior exit bullet hole.

## 2. Clothing—Shirt (front)

(378) There is a slit-like defect in the front of the shirt, measuring 3.8 centimeters in length and varying from 0.1 to 0.2 centimeter in width. The midpoint of the defect is 15.7 centimeters to the right of the midline and 27.9 centimeters below the shoulder seam. The long axis extends inferiorly and medially at an angle of approximately  $60^{\circ}$  from the vertical axis of the shirt. This joins medially a vertical linear tear measuring 3.1 by 0.1 to 0.2 centimeters and is paralleled by another vertical linear tear measuring 4.8 by 0.1 to 0.2 centimeters.

The difficulties of further characterizing these defects by laboratory examination were described earlier in the letter from Hoover to Rankin and in the report describing the nondestructive analyses (soft X-ray\* and energy dispersive X-ray\*) results obtained after examination of the clothing. (See fig. 37, a photograph of the front of Governor Connally's shirt, illustrating the location of the anterior, exit bullet hole.)



FIGURE 37.—Photograph of the front of Governor Connally's shirt, showing the location of the anterior exit bullet hole.



### 3. *Surgical report and interview with the surgeon*

(379) Dr. Shaw's operative record characterizes the exit wound as follows:

[The missile] emerged below the right nipple \* \* \*  
[T]he wound of exit was a ragged wound approximately 5 centimeters in its longest diameter. (61)

(380) Subsequently within his report, Dr. Shaw described his operative procedure: "An elliptical incision was made around the wound of exit removing the torn edges of the skin and the damaged subcutaneous tissue." In a committee interview, Dr. Shaw further localized and characterized the exit wound in a drawing in which he attempted to reproduce the actual size of the exit defect (see fig. 35).

(381) In Dr. Baden's report of his recent examination of Governor Connally, he localizes the residua of this wound as follows:

The exit wound scar is in the right front chest 1 inch below the central nipple line and has been incorporated in a surgical scar that is  $9\frac{1}{2}$  inches long that extends from 3 inches to the right of the midline, 1 inch beneath the nipple line, and proceeds superiorly to the right upper posterior axillary area. (62)

#### *Course of the missile through the back (thorax)*

##### 1. *X-rays*

(382) Dr. J. Reynolds' X-ray report includes the following which is relevant to the missile's path through the thorax:

Anterior-posterior film of the chest was obtained on November 22, 1963. There is marked soft tissue swelling of the lateral aspect of the right thorax and free air is seen in the soft tissues at this site and in the region of the axilla.\* The right fifth rib is fractured in several places. The right lung base shows a dense confluent infiltration presumed to be the result of pulmonary contusion.\* No free pleural fluid\* or pneumothorax\* is identified at this time but the shadow of a safety pin is superimposed on the right hemithorax, perhaps marking the site of a chest tube. (63)

(See fig. 38, a reproduction of the anterior-posterior\* X-ray film of the chest of Governor Connally, illustrating the multiple fractures of the right fifth rib and the contusion of the right lung.)

(383) The report states further:

A subsequent film on November 23, 1963 was taken in posterior-anterior projection. Again, it shows that the right base is obscured by a homogeneous density which probably represents pulmonary contusion.\* The heart and mediastinum\* the study of the previous day. (64)



FIGURE 38.—Photograph of the anterior-posterior X-Ray film of the chest of Governor Connally, showing the multiple fractures of the right fifth rib and the contusion of the right lung.

*2. Surgical report and interview with the surgeons*

(384) Dr. Shaw's operative record characterizes the pathway of the missile and its effects as follows:

The incision was then carried in a downward curve up toward the right axilla\* so as to not have the skin incision over

the actual path of the missile through the chest wall. This incision was carried down through the subcutaneous tissue to expose the serratus anterior muscle\* and the anterior border of the latissimus dorsi muscle.\* The fragmented and damaged portions of the serratus anterior muscle were excised. Small rib fragments that were adhering to the periosteal tags were carefully removed preserving as much periosteum\* as possible. The fourth intercostal muscle bundle and fifth intercostal muscle bundle were not appreciably damaged. The ragged ends of the damaged fifth rib were cleaned out with the rongeur. The pleura had been torn open by the secondary missiles created by the fragmented fifth rib. The wound was opened widely and exposure was obtained with a self retaining retractor. The right plural [pleural] cavity was then carefully inspected. Approximately 200 cubic centimeters of clot and liquid blood was removed from the plural [pleural] cavity. The middle lobe had a linear rent starting at its peripheral edge going down toward its hilum and separating the lobe into two segments. There was an open bronchus in the depth of this wound. Since the vascularity and the bronchial connections to the lobe were intact it was decided to repair the lobe rather than to remove it \* \* \* This laceration had undoubtedly been caused by a rib fragment \* \* \* There was no evidence of injury of the mediastinum and its contents \* \* \* The upper lobe was found to be uninjured \* \* \* It was found that the latissimus dorsi muscle although lacerated was not badly damaged \* \* \* (65)

(385) Dr. Shaw's recent committee interview report contains this recharacterization of the findings of his procedure:

There was a smaller tunneling wound in the back/chest. The bullet struck the fifth rib in a tangential way pushing it out, causing a fracture at a point farther up the rib (like a tree limb breaking from pressure exerted near its end). Bullet and rib fragments exited out the front of the Governor causing the larger exit hole.

Shaw said the lower two-thirds of the Governor's lower lung lobe was like liver, full of blood and holes caused by secondary (bone) missile fragments. There was a rent in the latissimu dorsi. (66)

(386) Dr. Petty, also present at Dr. Shaw's interview, summarized Dr. Shaw's observations concerning the course of the missile:

There was a tunnel made by the missile in passing through the chest wall.

The bullet struck the fifth rib in a tangential manner and shattered approximately 10 centimeters of the posterior and lateral aspect of the fifth rib. The serratus anterior muscle was torn and the fifth and sixth intercoastal muscles were intact and the periosteum of the rib was nearly intact.

Shaw removed more of the fifth rib to enter the chest wall. There was damage of the middle lobe of the right lung due to



the impact upon the chest. It actually was ripped into two segments and there was a leak in the bronchus. The lower two-thirds of the lower lobe of the right lung looked just like liver, "just a bag of blood."

Shaw repaired the right middle lobe. It inflated well. There was no need to touch the lower lobe of the right lung except for a 1 centimeter long rent in it. This was oversewn. (67)

(387) In his summary of the interview, Dr. Petty suggested that the missile tunneled around the chest wall and did not proceed in a straight line from entrance to exit.

(388) The majority of the panel members, however, disagree. They would have expected a comparable missile, which was slowed only by passage through the President's neck and by striking only a relatively thin and readily shattered rib, to pass from entrance to exit in a fairly straight line and to perforate the lung. They are not certain that the surgeon could have known whether the injury to the lung was caused by the missile or by rib fragments only. They cannot conclude solely from the findings on the internal injuries whether the missile which injured Governor Connally had struck an intervening target. They note, however, that the findings are entirely consistent with such a path. The relatively large back entrance perforation is indicative of the missile having first struck an intermediate target, and the relative lack of damage to the bullet is believed by some panel members and Larry M. Sturdivan, the wound ballistics expert, to indicate that the missile had passed through other tissue, slowing it down, before it hit the Governor, striking his rib and wrist.

(389) Dr. Baden's report comments on the angle of the trajectory:

Positioning the Governor while erect in the anatomic posture shows the missile track to proceed from back to front, downwards at approximately a 10 degree angle, for a distance of 12½ inches through the body. (68)

*Reentry wound into the dorsum (top or back) of the right wrist*

### *1. Clothing—Suit jacket*

(390) There is an irregular defect through all layers of the medial edge of the right sleeve of the coat, located 1.9 centimeters from the medial sleeve seam posteriorly; it measures 1.6 by 0.9 centimeters and involves both anterior and posterior (front and back) surfaces, representing the defect of both entry and exist in the coat sleeve.

### *2. Clothing—shirt*

(391) There is a defect which passes through both layers of the French cuff of the right shirt sleeve. The defect on the outer layer of the cuff measures 1.6 by 0.9 centimeters, that on the inner layer of the cuff 1.8 by 0.5 centimeters. These two defects approximate each other and are 10.0 centimeters from the cuff margin and 10.6 centimeters medial to its anterior corner.

### *3. Medical record review*

(392) Dr. Charles Gregory's operative record describes the wound of entry on the Governor's wrist:

The wound of entry on the dorsal aspect\* of the right wrist over the junction of the right distal fourth of the radius and shaft was approximately 2 centimeters in length and rather oblique with the loss of tissue with some considerable contusion at the margins of it. (69)

This enlarged entrance perforation is suggestive of a reentrance wound.

(393) Dr. Vernie A. Stembridge's surgical pathology report includes a characterization of the wound to the dorsal surface of the wrist:

Specimen (A) consists of an ellipse of skin which is white and hairy measuring 30 millimeters by 10 millimeters by 6 millimeters. In the middle of the epidermal\* portion of the specimen is a ragged laceration extending into the dermis\* and measuring 10 millimeters by 2 millimeters by 2 millimeters. A small amount of hemorrhage is present in the subcutaneous tissue and dermis.\*

Microscopic examination of skin from the right wrist reveals a focal absence of epithelium\* with hemorrhage and disruption of the underlying dermis and soft tissue. (70)

(394) The panel considers this histologic description to be consistent with the defect being an entrance wound.

*Exit wound on the volar (lower) surface of the right wrist*

1. *Clothing—Suit jacket (see above)*

2. *Clothing—Shirt*

(395) The defect passes through both layers of the French cuff of the right shirt sleeve on the under surface. It measures 1.9 by 1.3 centimeters in the outer layer and 2 by 1.5 centimeters in the inner layer. It is 2.8 centimeters from the cuff margin and 11.3 centimeters medial to its posterior corner.

3. *Medical record review*

(396) Dr. Gregory's operative record characterizes the exit wound on Governor Connally's wrist as follows: "There was a wound of exit along the volar\* surface of the wrist about 2 centimeters above the flexion crease of the wrist and in the midline." (71)

*Course of the missile through the right wrist*

1. *Medical record review*

(397) Dr. Gregory's operative record describes the course of the missile through the wrist:

It was noted that the tendon of the abductor palmaris brevis was transected, only two small fragments of bone were removed, one approximately 1 centimeter in length and consisted of lateral cortex which lay free in the wound and had no soft tissue connections, another much smaller fragment perhaps 3 millimeters in length was subsequently removed. Small bits of metal were encountered at various levels throughout the wound and wherever they were identified and could be picked up were picked up and have been submitted to the pathology department for identification and

examination. Throughout the wound and especially in the superficial layers and to some extent in the tendon and tendon sheaths on the radial side of the arm are small fine bits of cloth consistent with fine bits of Mohair. It is our understanding that the patient was wearing a Mohair suit at the time of the injury and this accounts for the deposition of such organic material within the wound.(72)

(398) Dr. Stembridge's report characterizes the tissue removed from the right wrist:

Specimen (C) is labeled bone and debridement from right wrist and consists of several small pieces of tissue. Two small fragments each 3 mm. in greatest dimension appeared to be pieces of cotton and/or wool. Two other small pieces, the largest of which measured 8 millimeters by 3 millimeters by 2 millimeters and the smallest of which measured 3 millimeters by 3 millimeters by 2 millimeters appear to be soft tissue. The other portion of the specimen consists of three irregular fragments of bone, the largest of which measures 1 centimeter by 5 millimeters by 3 millimeters and is composed of both cortical and cancellous bone and the other two measuring 6 millimeters by 2 millimeters by less than 1 millimeter and appearing to be composed of cortical bone only. The soft tissue fragments are submitted for microscopic examination.

Microscopic examination of debridement from the right wrist reveals multiple fragments of bone, and small amounts of fibrofatty connective tissue. Embedded within the fibrofatty tissue is a small segment of fragmented peripheral nerve.(73)

The panel concludes that its findings further indicated that the missile had passed through Governor Connally's suit jacket and wrist and had remained intact.

(399) Dr. Baden, in his recent examination of Governor Connally, localizes the residua of these wounds:

Examination of the right wrist shows the gunshot wound of entrance to be incorporated into a well healed surgical dorsally and extending to the wrist; there are well healed fine surgical scars on the ventral aspect (undersurface) of the wrist, horizontally and longitudinally.(74)

## 2. X-Rays

(400) Dr. J. Reynolds' X-ray report describes the wound in the wrist:

Films of the wrist were obtained on November 22, 1963, and they show a comminuted fracture\* of the distal portion of the radial shaft. In this area, in the volar aspect of the distal forearm, a few small metallic fragments are seen in the soft tissue. The alignment of the bone at the fracture appears good.(75)

(See figs. 39, 40, and 41 and reproductions of the X-rays.)





FIGURE 39.—Photograph of an X-ray of the wrist, showing the extent of the fracture and missile fragmentation.



FIGURE 40.—Photograph of an X-ray of the wrist, showing the extent of the fracture and missile fragmentation.



FIGURE 41.—Photograph of a LogEtronic enhancement of a wrist X-ray, showing more clearly the extent of the fractures and missile fragmentation.

*3. Disposition of the missile fragments from the wrist*

(401) An FBI report by Special Agent J. Doyle Williams, dated November 30, 1963, describes the disposition of the missile fragments, about which there are some confusion:

Doctor Charles Francis Gregory, Parkland Hospital, stated he and Doctor Tom Shires and other staff physicians per-



formed surgery on Governor John Connally on November 22, 1963. He states surgery performed by him was done on the Governor's right arm, and that he removed from the arm a small fragment of metal. He stated the metal fragment was placed into a transparent container for preservation, and that during the operation, he recalled no other pieces or bits of metal being removed from the Governor's body.

Doctor Gregory was asked whether or not he removed or saw another doctor remove a small fragment of metal from the left thigh of Governor Connally, and he states that although X-rays indicated the possibility of a small fragment of metal embedded in the left thigh that no surgery was performed to remove same.

Doctor Gregory stated Surgery Supervisor Audrey Bell took custody of the fragment of metal removed from the Governor's arm, and that the ultimate disposition of the metal which was considered to be of possible evidentiary value, could best be explained by Miss Bell. He stated he did not on his own knowledge know, however, but he had been advised [that] Miss Bell obtained a receipt from State Trooper Bob Nolan [a State of Texas highway patrol officer] and transferred the metal fragment to him in accordance with instructions from the Governor's office at Parkland Hospital. (76)

In another FBI report, dated November 23, 1963, Special Agent Williams said:

Bobby M. Nolan, Texas highway patrolman, Tyler district, was interviewed relative to a bullet fragment removed from the left thigh of Governor Connally, which was turned over to him at Parkland Hospital in Dallas for delivery to the FBI.

Nolan stated his instructions were apparently not clear at the outset and that following contact with his superior officers while at the Dallas Police Department, he turned the bullet fragment over to Captain Will Fritz [Dallas Police Department] at approximately 7:50 p.m. He stated he had no further information concerning the matter and that his only participation in this series of events was the acceptance of the fragment and delivery of same to Captain Fritz. (77)

(402) All the panel members except Dr. Wecht agree, after a review of the notes of Drs. Gregory and Shires on the operation, that the missile fragment that Officer Nolan attributed to the thigh was probably the fragment recovered from the right wrist. This fragment is labeled "Q9 metal fragment from arm of Governor John Connally" in FBI report "DL 89-48" and in correspondence addressed to Dallas Police Chief Jesse E. Curry.

(403) All the panel members except Dr. Wecht would have expected a comparable rifle missile perforating the wrist, without being slowed by striking an intervening target, to have produced significantly greater soft tissue and bone injury and a smaller skin entrance perforation. They also agree that the method of labeling and handling this evidence was so poor that there might have been difficulty in having it admitted as evidence in a criminal proceeding.

*Reentry wound in the left thigh**1. Clothing—Trousers*

(404) There is a defect of the left pant leg 61.5 centimeters below the top of the trousers and 6.4 centimeters medial (inward) to the crease of the pants; it measures 0.7 by 0.9 centimeter and is rectangular in shape. (See fig. 42, a photograph of the defect in Governor Connally's trousers.)

*2. Medical record review and interview of the surgeons*

(405) Dr. Shires' operative record characterizes the thigh wound as follows:



FIGURE 42.—Photograph of the suit trousers of Governor Connally, showing the location of the missile defect.

There was a 1 centimeter punctuate missile wound over the juncture of the middle and lower third, medial aspect, of the left thigh. X-rays of the thigh and leg revealed a bullet fragment which was embedded in the body of the femur\* in the distal third. The missile wound was seen to course through the subcutaneous fat and into the vastus medialis.\* The direction of the missile wound was judged not to be in the course of the femoral vessel, since the wound was distal and anterior to Hunter's canal. (78)

(406) Dr. Stenbridge's report characterizes the tissue removed from the left thigh as follows:

Specimen (B) is labeled skin from left thigh and consists of an ellipse of white skin measuring 22 by 8 by 7 millimeters. In the center of the ellipse is a 6 by 4 by 3 millimeter oval laceration extending down into the subcutaneous tissue from the epidermis.\*

Microscopic examination of the tissue from the left thigh reveals an area from the epithelial puncture with complete disruption of the underlying dermis and soft tissue producing necrosis.\* PP/md Pathologic diagnosis: "Tissue from left thigh: Recent hemorrhage (history of gunshot wound.)" (79)

(407) The report on the committee interview with Dr. Shires states that his examination of the thigh was:

"\* \* \* largely an exploration to insure there was no vessel damage." [T]he only significant wound in the thigh was a missile track. He says he merely did a debridement. When asked if the thigh wound could have been caused by a secondary fragment, Dr. Shires said, you "\* \* \* can't tell anything from the size or shape of the wounds as to whether or not it is an entrance or exit wound." He said that when dealing with fragments, there are too many unknown variables and that it is hard to differentiate fact from fiction. [He also said] the wound was small and that the thigh had very little damage and did contain a metal fragment. Dr. Shires was asked about his Warren Commission testimony that noted a peculiarity in the nature of the wound; namely, that the tissue damage seemed more significant than the size of the fragment present. He said that it is difficult to determine how the fragment entered. He said, "\*\*\* all you can say is that a tangential wound occurred." He said that there was a large range of possibilities for what happened.

Significantly, Dr. Shires said the main issue he was seeking to resolve by the examination of the thigh was whether the missile could have hit a major vessel. He said it did not, and that he did not physically pursue the fragment that was there because it was "\*\*\* not medically significant." Dr. Shires said he was able to determine that the fragment was in the thigh bone from his examination of the original Connally X-rays. (80)



(408) After reviewing the three original thigh X-rays and the enhancement (LogEtronic\*) of these X-rays, Dr. Shires indicated:

[I]t doesn't make any difference whether the metal fragment is in the femur\* or just under the skin with regard to the issue of whether there was a full bullet striking the thigh or a fragment of a bullet. He said the wounds were probably caused by a tangential hit. He said a tangential wound could have sent the fragment anywhere into the thigh. Dr. Shires noted that on the enhancement of the thigh (LogEtronic\*) the item in the bone looks more like an artifact than when he examined the original. He was openminded about the possibility that the fragment could have been just under the skin, but preferred to reiterate his initial impression that the fragment was in the thigh bone. Dr. Shires said that while they explored the entire track of the missile, they were not "\* \* \* exploring it as a track \* \* \*," rather they were "\* \* \* exploring the wound looking for a big missile injury." Dr. Shires found little hemorrhage, though he thought it was likely that a high velocity missile did not pass through the skin causing the wound.(81)

(See figs. 43 and 44, enhanced X-rays of Governor Connally's thigh.)

### 3. X-rays

(409) Dr. Reynolds' report on Governor Connally's X-rays describes the X-ray of the left femur and left lower leg:

Film of the shaft of the left femur and of the left lower leg reveals no fracture in this area. A tiny metallic fragment is seen in the lower medial aspect of the thigh, in the subcutaneous fat.(82)



FIGURE 43.—Photograph of a LogEtronic enhancement of a thigh X-ray, showing the location of the missile fragment in the subcutaneous fat.



FIGURE 44.—Photograph of a LogEtronic enhancement of a thigh X-ray, showing the location of the missile fragment in the subcutaneous fat.

(410) On November 29, 1963, Dr. Reynolds prepared a supplementary X-ray report which further characterizes the shadows within the thigh:

AP (anterior-posterior) and lateral films of the digital portion of the left thigh were obtained and include the distal portion of the shaft and the region of the knee. One film is in the AP projection and the other the lateral projection with the direction of the beam from medial to lateral and the film lying adjacent to the lateral aspect of the thigh.



No fractures are seen. A few punctuate and linear densities are seen on the film but these are inconsistent, and appear on one and not the other and therefore interpreted as artifacts.

There is, however, one density which remains constant on both films and appears to lie beneath the skin of the region of the subcutaneous fat in the medial aspect of the thigh. By measurement on the films, without correction for target film distance and object film distance, this small density lies 15.2 centimeters above the distal end of the medial femoral condyle\* on the AP film and, on this film, lies 8 millimeters beneath the external surface of the skin. It is 6.25 centimeters medial to the femoral shaft. On the lateral film, the center of this small metallic density lies 15 centimeters above the distal end of the medial femoral condyle. It lies 4.9 centimeters posterior to the skin of the anterior surface of the thigh and it is superimposed on the shaft of the femur.\* In relation to the femur, the density is superimposed on a point 1.5 centimeters posterior to the exterior of the anterior cortex.

The shape of this density is irregular but is roughly oval. Precise measurements are difficult but it is estimated that the greatest length in the AP projection is about 3.5 millimeters and the greatest width about 1.3 millimeters.

Measurements of the densities in the lateral projection reveal the greatest length to be about 2 millimeters and the greatest width to be about 1.5 millimeters. The long axis of the metallic object is oriented generally along the axis of the femur. (83)

(411) The panel concurs with Dr. Reynolds' opinion that the 2-millimeter density is a missile fragment that was just under the skin and was not deep within the thigh in the femur bone, as described in the Warren Commission Report. The panel believes the density in the femur bone was erroneously described and is an artifact in the X-ray film and not a bullet fragment.

(412) The panel members, except Dr. Wecht, agree that in their experience a comparable rifle missile that did not strike an intervening target would produce greater soft tissue and bone injury and would penetrate much deeper into the thigh and probably pass through it.

*4. Nondestructive analysis of tissues from the right wrist and left thigh and of slides prepared from them*

(413) Panel member Dr. Petty obtained the paraffin blocks containing residual tissue excised from the wrist and thigh of Governor Connally from Vernie A. Stenbridge, M.D., the original examining surgical pathologist. Dr. Petty subjected the tissue to nondestructive analysis at the Southwestern Institute of Forensic Sciences in Dallas, using techniques which employ X-ray back scatter\* with scanning electron microscopy\* and energy dispersive X-ray\*. The report of this examination states:

The three microscopic slides were examined and no evidence of metallic fragments was noted either by direct observation or by seeing evidences of tearing of the tissues which might have occurred as a result of the nicking of the microtome knife

due to contact with metallic fragments that would occur during preparation of the microscopic slides.

The paraffin blocks containing the tissues from the debridement were then subjected to energy dispersive X-ray analysis. No evidence of copper, lead, zinc, or nickel was found.

After preparation the paraffin blocks\* containing the tissues removed at the time of debridement and still remaining following the preparation of microscopic slides were subjected to analysis using a scanning electron microscope fitted with a low angle detector for X-ray back scatter. No copper, lead, zinc, or nickel was found by means of this analysis. (84)

(See addendum H for the complete report.)

(414) The panel conclude that no metal fragments were present in the available tissues removed from the injured wrist and thigh for possible further analysis and comparison.

#### SUMMARY OF THE FORENSIC PATHOLOGISTS' PERSPECTIVE OF WOUND BALLISTICS

(415) To understand better the significance of the panel's observations and the bases for its conclusions, it is useful to review some of the terminology and basic concepts of wound ballistics and to indicate the limitations that certain variables impose on interpreting the findings. Some of these factors were considered and recorded in a reasonably accurate manner during the original autopsy and subsequent experimentation; others were not.

(416) The forensic pathologist is trained to observe the morphologic (structural) or physical effects of a missile or missiles on a body and to interpret these effects in order to provide an investigator with as much information as possible, as detailed in section V of this report, including: the distance or range of the weapon from the body; relationship of the weapon and trajectory of the missile to the body; approximate mass and velocity of the missile (which together characterize its kinetic energy); and the amount of this kinetic energy transferred from the missile to the body after striking, together with the results of such impact on, or perforation of, the tissues damaged and the body as a whole. These observations will be discussed separately, with particular emphasis on their relationship to specific evidentiary items examined.

#### *Range of the weapon from the target*

(417) A missile must have sufficient velocity (speed) to cause a particular wound. The velocity depends on the type of ammunition employed, including the type of powder and powder charge. Velocity drops off as the distance between the weapon and the target increases.

(418) The missile is not the only object that emanates from the firearm. Expanding gas produced by the burning of the powder, which actually pushes the missile out of the bore of the firearm, bursts forth from the muzzle with great velocity, causing the audible report associated with discharge. Powder grains are also blown out of the muzzle; these may be partially burned or completely unburned. Thus, gas,

powder and missile are all actually forced out of the bore of the weapon in any discharge of a firearm.

(419) The incandescent nature of the gas also causes flame and heat to emanate from the muzzle. In addition, small fragments of the missile itself and its coating are forced from the muzzle, together with any fragments of material that may have been in the bore of the weapon.

(420) The forensic pathologist estimates the range of fire and other particulars concerning injury from a firearm by examining the pattern of deposit of these substances about the bullet's point of impact on either the body or the clothing. Distance may be determined by comparing the pattern of these deposits with patterns produced by the same weapon fired with similar ammunition under similar environmental conditions at selected distances, with the weapon in a comparable position relative to the surface. Terms such as "contact," "close range" and "intermediate range" are used to characterize the shooting; characteristic details can vary from weapon to weapon and with various types of ammunition.

(421) When a weapon is fired close against the skin's surface, virtually all the substances, including those from the muzzle blast itself, penetrate the skin to the underlying tissues, where they may be detected by physical or chemical means. In addition to these deposits, the missile itself is often coated with a lubricant in which microscopic and macroscopic particles of primer or powder charge residue may be mixed, which, barring an intermediate target between the weapon and the body, are usually deposited at the margins of the perforation of the clothing or the skin. This residue is termed "bullet wipe" by the forensic pathologist.

(422) If all the above-mentioned residues are missing except "bullet wipe," the gunshot wound is characterized as a "distant" wound, meaning that the muzzle of the weapon was discharged at a distance from which it would cause no residue to be deposited on the target. Such a wound consists of a missile perforation about which there might be a deposit of bullet wipe on the clothing and/or in the superficial margins of the wound; this is in addition to the abrasion collar, described earlier, produced when the entering bullet rubs against the margins of the indented skin.

(423) Wound ballistics research has shown that a missile velocity of 125 to 170 feet per second is necessary for penetration of the human skin when using steel spheres varying from one-sixteenth to one-quarter inch in diameter. Clothing also impairs perforation, but is usually less efficient than skin in hindering penetration, depending on its nature. The size of the defect in the skin varies considerably depending on the size and velocity of the missile. Skin is extremely elastic; it often stretches considerably to allow missile penetration and then returns to its normal shape thereafter, leaving a defect smaller than the missile itself. Close proximity of the weapon to the skin or bone beneath the skin and the angle of impact may enlarge the entrance perforation.

(424) The characteristics of the abrasion collar surrounding the entrance perforation reflect the direction of the bullet at the instant of impact with the skin and the angle of the trajectory prior to contact with the skin, as well as the shape of the missile itself. If the trajectory is perpendicular to the surface of the skin, the hole is usually round



and the abrasion collar correspondingly symmetrical around it. (See fig. 45, a picture of an abrasion collar when the missile was perpendicular to the target.) If the angle of the trajectory of the missile to the skin surface is other than perpendicular, the abrasion collar may be asymmetrical, that is, more prominent on the surface with the most acute angle between the skin and the bullet, and less apparent on the opposite surface, where there may be undermining of the tissues. (See fig. 46, showing an abrasion collar produced by a missile striking at an acute area.)

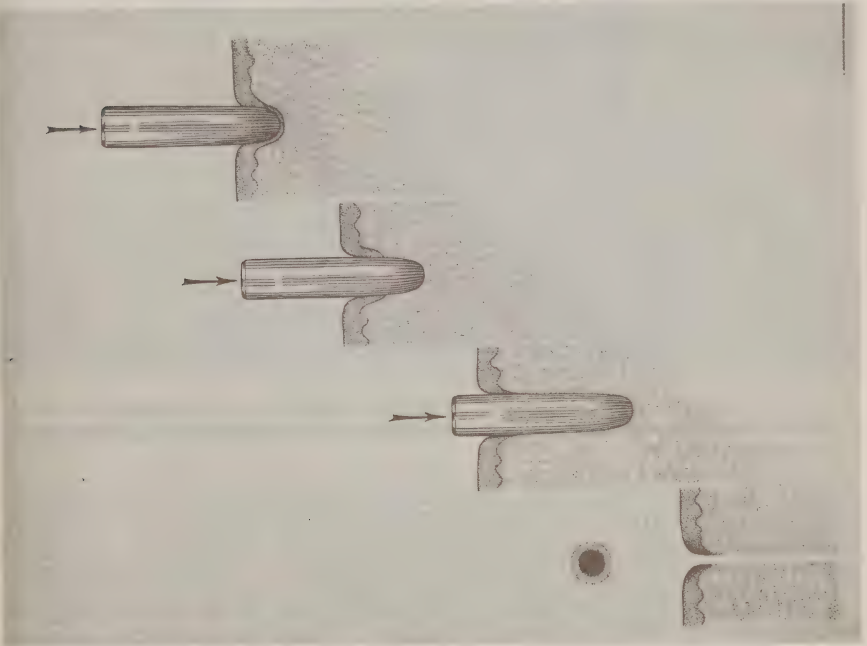


FIGURE 45.—Drawing of a typical entry wound, displaying a symmetrical abrasion collar resulting from a distant rifle shot with a trajectory at right angles to the skin surface.

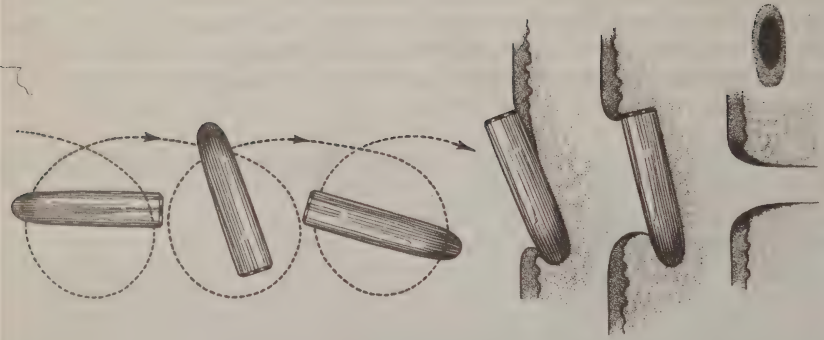


FIGURE 46.—Drawing of a typical entry wound, displaying an asymmetrical abrasion collar resulting from a distant rifle shot with a trajectory at an acute angle to the skin surface.

(425) If a missile strikes an intervening target, its normal yaw\* may be exaggerated, or it may begin to tumble.\* The entry wound in a subsequent target might reflect this distortion in trajectory by anything from a very slight asymmetry to an ovoid or virtually rectangular reentry wound. The latter would be the case if the missile were to strike sideways and is somewhat similar to what was described in some of the initial medical reports on the wound in the posterior thorax of Governor Connally. (See fig. 47, a drawing showing yawing or tumbling.) Such a subsequent entry wound might show no wipe residue in the skin because of the missile's prior passage through skin and tissue. Some small fragments of the metal from the missile's surface might break off as the missile strikes, however, and adhere to the margins of the defects in either the clothing or skin.

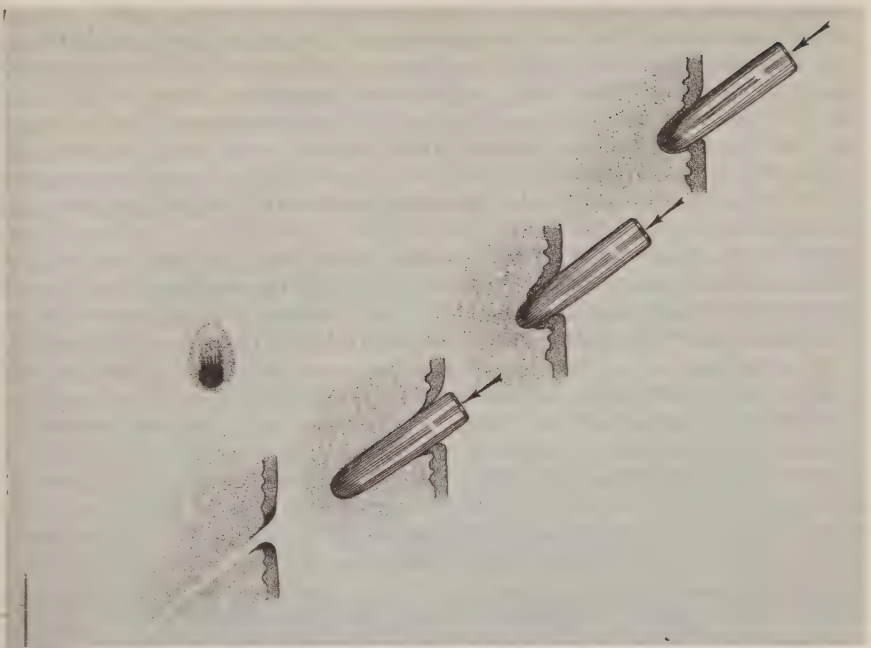


FIGURE 47.—Drawing of an entry wound caused by a tumbling or yawing missile.

(426) A missile's path may also be deflected from a true straight line by striking an intervening target, with the extent of deflection usually based on the mass of the intervening object. Slight deflection could result from striking a twig or small branch of a tree. The panel members fully considered the potential effects of intervening targets on yaw and deflection of the missiles and their possible significance to bullet paths and injury patterns.

*Relationship of the weapon and missile trajectory to the target*

(427) The accuracy of a weapon is provided by the spin imparted by the rifling\* within the weapon and, to a lesser degree, the shape of the projectile. An elongated, symmetrically shaped missile is a more accurate than an irregular or spherical one. Other considerations in accuracy are distance to the target, effect of gravity on the missile while in flight, and effects of air resistance. Air resistance varies considerably with the speed of the missile. A very high velocity missile, after leaving the weapon, loses its speed at a much greater rate than does a low or intermediate velocity missile.

(428) A missile's pathway from the weapon to the target is known as its trajectory. A bullet should travel only a short distance after leaving the barrel before it stabilizes, minimizing the tendency to yaw.\* During the first hundred yards or so, the bullet yaws\* periodically, with its tip oscillating slightly from the line of flight. While in flight, the bullet's movement, although much quicker because of its high rate of spin, mimics that of a spinning top. At one instant the bullet is point on, at the next its axis is at a slight angle to the line of flight. These motions are periodic. This angle of yaw\* increases to a certain



degree and then progressively decreases until it is again zero, whereupon another similar gyration commences. During flight the degree of yaw\* is normally comparatively slight, usually less than  $3^{\circ}$  in properly designed bullets of the type used in this homicide, except when near to the terminal, or maximum, range from the weapon. The tendency to yaw\* increases in proportion to the density of the medium through which the missile passes relative to air; in tissues it may be increased many times more than in air (approximately 800), resulting in rapid, complex bullet motions.

(429) The yaw\* of a bullet passing through a body may be rather extreme from point to point. Nevertheless, in the experience of panel members, if the missile enters the body without tumbling\* or appreciable yaw,\* its pathway or track is essentially a straight line as long as it does not strike a significant bony surface. To reconstruct this linear path, the tissues may be placed in the same anatomic relationship to each other as they were at the time of missile perforation. Consequently, in the absence of an intervening target, the missile's trajectory from point of origin to the body represents a backward extension of the bullet's pathway within the body. Bone or other extremely dense tissue, such as cartilage, in the immediate pathway of the missile might alter the angle of the track through the body after the characteristic skin perforation. This alteration is distinguishable from that produced by yaw,\* which, at a particular point in the passage through the body, might cause the missile to be out of line with its pathway, although the pathway itself remains straight.

(430) The panel believes that the difficulty which Drs. Humes, Finck, and Boswell experienced in trying to place a soft probe through the bullet pathway in President Kennedy's neck probably resulted from their failure or inability to manipulate this portion of the body into the same position it was in when the missile penetrated. Rigor mortis may have hindered this manipulation. Such placement would have enabled reconstruction of the relationships of the neck and shoulder when the missile struck. It is customary, however, to dissect missile tracks to determine damage and pathway. Probing a track blindly may produce false tracks and misinformation.

(431) The panel is concerned as to the degree of accuracy attainable in determining the missile trajectory based on backward extension of a bullet track from within the body, particularly if precision within the range of a few degrees is required. An intermediate or high velocity bullet creates a temporary bullet track relatively larger than that of the bullet itself. This precludes reconstruction within the required degree of accuracy.

(432) Another factor hampering precise determination of the bullet track by the backward extension method is imprecision in knowing the relative position of various portions of the body at the instant of missile penetration. For example, the placing of President Kennedy's arm in the position it was in at the instant the missile struck the back might not be important because the relatively medial location of the entrance wound probably would minimize significant interference by the shoulder movement. The exit wound in the neck, on the other hand, might move to either side as much as several centimeters if his head or neck were to be rotated normally.

(433) The alinement of missile tracks that passed through several parts of the same body enables recreation of the relationships of these structures at the moment when struck. This allowed Governor Connally's posture at the time he was struck to be recreated.

(434) The determination of the point of origin of a missile by backward extension from a bullet track through a body must take into account not only the above variable factors, but also requires knowing, reasonably precisely, the exact position of that portion of the body penetrated at the instant it was struck. Any motion of the body, no matter how slight, would alter the extended trajectory of the missile from the bullet track in the body considerably and thereby change the point of origin. The longer the distance of the trajectory, the greater the magnification of even the smallest error in determining body position or path in the body.

(435) In the panel members' experience, if a missile, having struck an intervening target, is tumbling\* significantly at the time it strikes a target, the missile's course through the second target is much more unpredictable, both as a result of its exaggerated yawing\* at the point of impact and its loss of kinetic energy prior to striking the second target. Thus, the track through the Governor is less reliable for use in determining origin than that through the President, if the bullet struck the President first.

(436) The panel members agree that in their experience, if a missile strikes an object capable of creating a shearing force, such as the skull, the bullet's pathway in the body might be significantly different from the line of its trajectory prior to impact. The missile fragment lodged within the margin of the entrance skull defect is evidence of obvious shearing force with lateral torque. The only conclusion that the panel members can reach as a group is that all of the missile's mass, small and large fragments alike, would have moved forward from the point of impact with such a bony surface. The degree of lateral movement of the pathway would be influenced by the surface's convexity, amount of kinetic energy propelling the missile forward, and nature of the tissue through which the missile fragments were traveling.

(437) In the present case, the anterior-posterior and lateral X-rays of the skull indicate that the vast majority of the missile fragments moved in a cylindrical, slightly coned, pathway, in the same direction as the bullet's path prior to its striking the skull.

#### *Wounding capability of the missile*

(438) A missile's wounding capability is a consequence of the transfer of kinetic energy from the missile to the body. A missile's kinetic energy is the same as that of any moving object:  $KE = mv^2/2g$ , where  $m$  is the weight in English pounds and  $v$  is the striking velocity in feet per second. The results in conventional foot-pounds are derived by dividing by 2 times the acceleration due to gravity (32.2 feet per second per second). From this formula it can be deduced that the missile's kinetic energy varies as the square of its velocity. Thus, doubling the velocity increases the kinetic energy by a factor of 4, while doubling the mass serves only to double the kinetic energy.

(439) A missile passing through a body produces, around the wound track, a hemorrhagic area composed of the tissues which have been torn by the direct impact of the bullet. The missile creates a permanent



cavity, the size of which is generally proportional to the missile's total loss of kinetic energy while in the wound. As the bullet passes through the tissue, considerable radial motion is imparted to the tissue elements and a large temporary cavity is formed. When the wound track is dissected, extensive bleeding and tissue injury may be found extending for a considerable distance away from the track produced by high velocity bullets. After sectioning the tissues, this hemorrhagic area is often well-defined; its extent is proportional to the missile's loss of kinetic energy while in the wound. High speed X-rays and motion pictures have also demonstrated the formation of this temporary cavity, with a volume that may be as much as 27 times that of the permanent cavity.

(440) The panel agrees that the tissue disruption due to the temporary cavity created by passage of a high or intermediate velocity missile might have produced fractures of the transverse processes of one or several of the lower cervical and/or upper thoracic vertebrae in President Kennedy's neck, as indicated by the postmortem X-rays. There are significant muscle masses attached to the vertebrae which would receive tremendous shock, even if several inches distant from such a missile. A direct grazing missile impact may have occurred, but it would not have been necessary to cause the damage visible in the X-rays.

(441) The missile's rate of energy loss in the wound and the consequent transfer of this energy to the body is dependent on several factors, including the amount of initial energy and the degree of retardation of the missile within the body. This retardation varies according to the missile's shape, the density of the tissues through which it is passing, and its degree of yaw while passing through the target. A soft-pointed hunting bullet loses a greater portion of kinetic energy than a full, metal-jacketed military bullet, the ammunition used in this instance. In the case of a full-jacketed, nondeforming bullet, yaw\* is the most significant retarding factor as the bullet travels through the tissue. This yaw\*, as previously indicated, varies along the bullet's path, producing maximum energy loss at points where it is greatest and minimum energy loss where it is absent. A small entry hole through the skin, extensive internal damage, and a relatively small exit hole indicate that the bullet had minimum yaw\* at the moments of entrance and exit, with a release of energy, possibly due to yawing\*, in between.

(442) The changes in density from air to skin, muscle, and bone may produce marked variations in yaw\*. A bullet that is positioned appropriately relative to its trajectory on penetrating the skin may be tipped 90° to 100° within 3 inches of penetration, thus dramatically reducing speed, with a corresponding increase in energy transfer and tissue destruction. Subsequently its posture may again change, so that its long axis is in the line of flight and considerably less energy is lost and consequent tissue damage is minimized.

(443) The majority of the panel members, on the basis of the nature and extent of the Governor's chest injury alone, could not determine whether the missile that struck Governor Connally in the back had already passed through President Kennedy. They could, however, from the nature of the entrance wound in Governor Connally's back,



the nature of the damage to his wrist, and the limited penetration of his thigh, determine that the bullet which struck those areas had lost sufficient kinetic energy prior to inflicting these wounds to permit the conclusion that one bullet caused all of the wounds to the Governor. The panel cannot rule out the possibility, if confined only to the surgical evidence, that the wound to Governor Connally's wrist was caused by a large fragment of the bullet which struck the President's head.

(444) The majority of the panel members, after fully evaluating the objections of Dr. Wecht, believes that the medical evidence of a diminishing degree of injury to the chest, wrist and thigh, the ability to align these body parts to conform to a single bullet track, provide strong support for the conclusion that all of the Governor's injuries were caused by one missile.

#### *Effect of a missile on the body*

(445) The effects of a missile striking a portion of the body will conform to the basic laws of motion, readily understood and often observed in everyday occurrences such as the collision of a moving with a stationary billiard ball. If the two balls are of equal mass and the energy of the first is transmitted on impact to the second, the first ball will stop completely, while the second will be propelled at a velocity comparable to the striking velocity of the first. If the second ball is twice the mass of the first and the transmitted kinetic energy is comparable to that of the first, it will be propelled forward at only half the velocity. Much of the kinetic energy transferred by the first ball is due to its velocity, since its mass, relative to that of the second ball, is insignificant. Nevertheless, the sum of mass and velocity will result in significant imparted velocity to the motionless target.

(446) This situation can be best observed using nonjacketed missiles designed to impart maximum transfer of kinetic energy to the target during and after striking, thereby maximizing the missile's "knock-down" capability and minimizing the possibility of exit from the target and the striking of a second target. A jacketed missile transfers significant, but considerably less, kinetic energy to the target. Instead, the energy transfer propels the target body or a portion of it in the same direction as the missile. The vector of propulsion might affect the body in its entirety if the victim were standing, or might affect only the upper portion of the body if the victim were seated depending on the site of impact. The movement of the body, or of a large portion of it, will be minimal because of the bullet's small mass, notwithstanding its high velocity. If the bullet strikes the head, an object of relatively low mass in comparison with the entire body, the movement of the head in the direction of missile travel may be considerable. Rotational movement of the head, or of a lightweight portion of the body may also occur.

(447) By comparing the bullet tracks, a forensic pathologist may be able to determine if the wounds were inflicted on a body in an unsupported position that would permit movement, and, if so, in what order the wounds might have occurred. In cases where the body was in a supported position that would preclude motion, such as lying against a firm surface, a transfer of kinetic energy from the missile to

the body will result but not cause motion. Transmission of such energy to the body will be manifest by injury to areas in contact with the supporting surfaces.

(448) Accurate determination of the bullet pathway and careful observation of the missile wounds themselves are useful in determining whether several wounds to different portions of a body were caused by the same missile. By placing a rigid probe through the bullet tracks after careful dissection and inspection and after evaluation of deflections possibly caused by striking bone and other tissues, and then attempting to aline the tracks by moving the body, a conclusion may be reached as to whether multiple perforations were caused by a single missile.

(449) Bullet reentry wounds are often of a different configuration than initial entry wounds as a consequence of the missile's deformation during penetration and the tumbling effects produced. When various portions of the body are in contact during multiple perforations, one surface may serve to shore another from which a missile exits, so that the exit wound, even from an intermediate or high velocity missile, may exhibit little of the damage and tearing usually seen in exit perforations. Reentry wounds may also show adjacent injuries incident to secondary missiles\* from the primary injury. The primary wound or the reentry wound may contain fragments of clothing such as was present in the wound in Governor Connally's wrist.

#### *Effect of the body on a missile*

(450) The panel members individually have had considerable experience with how the various portions of the body affect missiles passing into or through them. Individually and collectively, they have seen the effects on missiles varying from .22 caliber long rifle bullets to those similar in size and velocity to the missiles used in this homicide—6.5 millimeters or 0.26 inch—and larger. In some cases the missiles had perforated similar portions of bodies—as in the upper back wound of President Kennedy, and thereafter penetrated significantly harder surfaces. These could not be distinguished from missiles fired through soft tissue alone. A bullet striking soft tissue decelerates so that if it then strikes a hard surface such as bone, it is appreciably less deformed than if it struck the hard surface directly. Dr. Wecht alone had had experiences contrary to this.

(451) Most panel members also agree that entrance penetrations of the skull by jacketed missiles, with the resultant shearing forces produced by impact with the sharp, rigid bone margins, often result in significant distortion of the missile, while perforation of the thorax or abdomen usually results in little or no deformation of the missile, except in those instances in which the missile hits a vertebra. Several members of the panel have investigated deaths in which missile impact resulted in deformation similar to the flattening noted in Warren Commission exhibit CE 399 and instances in which there was loss of the central core mass of a jacketed bullet as a result of deformation of the intact jacket and squeezing of the lead core backwards (a toothpaste effect).

(452) The panel members agree that in cases where jacketed missiles strike bony surfaces such as the skull, long bones or vertebra, a portion



or all of the jacket might separate at the point of initial missile deformation, with the central, heavy lead core continuing in a path usually in the same direction as that of the missile trajectory prior to entry into the target. It is not unusual for a portion of a missile to separate into additional fragments upon exiting from the skull or other part of the body and entering a second structure.

(453) Another consideration about missile wounds that has been emphasized by others(85) is the relatively short time that a missile is actually moving through tissue, usually less than a thousandth of a second. A bullet of 150-grains weight, passing through 8 inches of tissue, entering at 2,000 feet per second (approximately the velocity of the 6.5 millimeter Mannlicher-Carcano bullet) and exiting at 1,000 feet per second will pass through the body in 0.00045 second and impart to the tissue 998 foot-pounds of energy, the work equivalent of more than 4,100 horse power. This energy transfer produces a temporary cavity as described earlier, which actually develops after the bullet has passed through the tissue. Accordingly, a bullet can pass through a head and be about 100 feet further along before a photograph reveals the explosive destruction of the head. This also explains the presence of entry and exit bullet holes in bones and tissue even though the skull is extensively fragmented or blown apart by the subsequent formation of the temporary cavity. The velocity of the outward-moving tissue particles may be only 125 feet per second, far less than the 1,000 to 2,000 feet per second velocity of the bullet projectile. Thus, when the Zapruder film reveals the explosion of the skull, the bullet had already passed through.

(454) Finally, the panel members also discussed their experiences with the explosive effects of shotgun and, to a lesser extent, military rifle wounds to enclosed portions of the body such as the head. Rarely has any member observed photographs documenting the reactions of victims' bodies to being shot, although crime scene reconstruction has often enabled panel members to establish body position prior to the shooting. The panel members have critically evaluated the observations of Alvarez(86) and the physical principles he considers in explaining the President's head movements in the Zapruder film. The panel members took note of the differences between the missile and targets (melons) in Alvarez's work and the missile and targets in this homicide. The work of Lattimer and associates,(87) which addressed some of these differences by using a weapon and missiles similar to those used in the Kennedy assassination and which attempted to duplicate the injury pattern on skulls, was also critically reviewed, as were studies by Dr. John Nichols.(88)

(455) The panel members agree that the exit wound of a missile seriously deformed by initial penetration of the skull might be considerably larger than the entrance defect and that the forces related to yaw\* and the large temporary cavity created by the missile would usually be transmitted fairly equally throughout a closed space such as the skull. The larger exit defect in the front of the skull would theoretically permit greater exodus of tissue under pressure, and a resulting backward movement of the head could occur.

(456) The panel is aware of the time interval between the backward motion of the President's head and the earlier, slight forward motion, possibly caused by the initial missile impact and transfer of energy



to the head, as recorded in frames 313-314 of the Zapruder film. The panel further recognizes the possibility of the body stiffening, with an upward and backward lunge, which might have resulted from a massive downward rush of neurologic stimuli to all efferent nerves (those which stimulate muscles). The disparity in mass and strength between those muscles supporting the body on the back (dorsal surface) of the spine and those muscles on the front (ventral) surface could account, at least partially, for this type of motion, although it would be reasonable to expect that all muscles would be similarly stimulated.

(457) The panel suggests that the lacerations of a specific portion of the brain—the cerebral peduncles\* as described in the autopsy report (89)—could be a cause of decerebrate rigidity,\* which could contribute to the President's backward motion. Such decerebrate rigidity as Sherrington (90) described usually does not commence for several minutes after separation of the upper brain centers from the brain stem and spinal cord. It is, however, most intense in those muscles which normally counteract the effects of gravity.

(458) The panel is also aware of possible effects on motion that could be caused by the moving car within which the President sat.

(459) The panel concludes that the backward movement of the head following its forward movement occurred after the missile had already exited from the body and had created a large exit defect in the skull, and that it was most probably due to a reverse jet effect,\* or a neuromuscular reaction, or a combination of the two. The short interval between the two motions supports this explanation.

(460) One panel member, Dr. Wecht, suspects that the backward head motion might be explained by a soft-nosed bullet that struck the right side of the President's head simultaneously with the shot from the rear and disintegrated on impact without exiting the skull on the other side. The remaining panel members take exception to such speculation, since they are unaware of any missile with such capabilities. Further, the X-rays taken prior to the autopsy show no evidence of a second missile, nor do the photographs of the head and brain show evidence of any injury to the left side.

#### SUMMARY OF THE FORENSIC PATHOLOGY PANEL'S CONCLUSIONS CONCERNING THE MISSILE WOUNDS OF PRESIDENT KENNEDY AND GOVERNOR CONNALLY

(461) Pathology is that specialty of medicine concerned with the investigation and evaluation of disease and other abnormalities in the human body. Forensic pathology is that area of pathology concerned with the legal aspects of death and injury, and the ability to present and evaluate the manifestations of death in courts of law and legal proceedings. Forensic pathologists are routinely asked to evaluate or develop hypotheses that involve pathological abnormalities and to suggest circumstances that could have produced them. Although it is often hoped that such evaluations can be made with absolute certainty, forensic pathologists can rarely state unequivocally that a given situation is explainable by one and only one hypothesis.

(462) More commonly the forensic pathologist makes a conclusion

that has a reasonable degree of medical certainty or states that the evidence is or is not consistent with any given hypothesis. In some cases, more than one hypothesis may explain the evidence.

*Number, location, and nature of President Kennedy's wounds*

(463) The majority of the forensic pathology panel (in each case, all members except Dr. Wecht) conclude that President Kennedy was struck by only two bullets, fired from some distance to the rear of his limousine. One bullet struck the President in the right upper mid-back and exited the front of the throat. This occurred prior to or during the segment in the Zapruder film of the assassination when the President is obscured from view by the Stemmons Freeway sign. This wound might have proven fatal.

(464) The second bullet struck the President in the upper back of the head and exited somewhat forward and to the right through the top, causing a massive defect in the skull. This second wound was fatal in and of itself. The wound in the upper right midback measures approximately 0.9 by 0.9 centimeter in maximum diameter and was located approximately 5 centimeters below the shoulder and 5 centimeters to the right of the midline of the back. The wound cannot be located more precisely from the available evidence because the autopsy pathologists failed to measure it with reference to standard fixed body landmarks and did not dissect the missile track.

(465) A red-brown to black area of skin surrounds the wound, forming what is called an abrasion collar. It was caused by the bullet's scraping the margins of the skin on penetration and is characteristic of a gunshot wound of entrance. The abrasion collar is larger at the lower margin of the wound, evidence that the bullet's trajectory at the instant of penetration was slightly upward in relation to the body.

(466) The majority of the panel concludes that the bullet that struck the President in the back exited in the front of the neck, at approximately the third tracheal cartilage. The exit wound was almost obscured by a tracheotomy performed on the President at Parkland Hospital, but could still be observed afterward at the lower margin of the tracheotomy incision. This wound is located approximately at the point where the bullet would be expected to exit, given the nature of the entrance wound in the upper right back and the damage to the transverse process of the lower cervical and first thoracic vertebrae, which are situated on a line between the entrance and exit points.

(467) The panel believes that Parkland doctors mistakenly identified the defect in the neck as an entrance wound because of its small size, which is characteristic of an entrance wound but occurs not uncommonly in exit wounds caused by high velocity missiles that have passed through soft tissue. It is also possible that this exit wound may have been small because the tissues through which the missile exited were supported by clothing, inhibiting the normally extensive distortion or tearing often characteristic of an exit wound. In addition, the Parkland doctors had not looked at the President's back and did not realize there was another perforation.

(468) Compounding the oversight of the Parkland doctors was the lack of communication between them and the pathologists performing



the autopsy at Bethesda Naval Hospital who did not realize that the tracheotomy had been made through a bullet wound. The autopsy pathologists only saw the back wound. On learning the day after the autopsy that the incision had been made through an existing wound, the pathologists concluded that the missile which entered the upper back exited through the neck defect.

#### *Location of the head wound*

(469) The panel concludes unanimously that the head entrance wound was located approximately 10 centimeters above the external occipital protuberance and slightly to the right of the midline, near the upper convexity of the back of the head at the "cowlick" portion of the President's hair part. The external surface of the skin around the wound was very similar to that of the back wound.

(470) The autopsy pathologists did not describe this location in their report or in their testimony before the Warren Commission. It does correspond, however, to the location described by two separate teams of medical experts convened by Attorney General Ramsey Clark and the Rockefeller Commission, respectively, as well as by other independent medical examiners. Further, while testifying before this committee, Dr. Humes, the chief autopsy pathologist, changed his earlier testimony and supported the panel's conclusion as to the location of the wound.

(471) The panel notes that the skull X-rays, photographs of the head and photographs of the brain substantiate this location. The scalp wound, as it appears in the photographs, has many of the features described in the autopsy report, including size, an abrasion cuff which is more prominent on the lower margin than the upper, and linear tears extending radially from the upper margins of the wound. The scalp wound overlays skull damage characteristic of an entrance wound (inward beveling\*), also described in the autopsy report.

#### *Nature and trajectory of the missile striking the head*

(472) The majority of the panel concludes that only one missile caused the damage to the head. The nature of the damage is consistent with that caused by a jacketed missile. The X-ray evidence indicates that the missile fragmented on impact, produced a number of outwardly radiating fractures, and proceeded in an essentially straight and forward path and to the right, paralleling the upper surface of the head. This type of missile fragmentation is consistent with a jacketed missile. The main core mass probably existed in a single fragment that remained intact until striking the automobile, causing it to fragment into several pieces. The small missile fragment present at the margin of the entrance wound was probably a portion of the missile jacket and indicates that the skull might have slightly deflected the course of the missile and its fragments through the head.

(473) The bullet exited in the top front area of the skull (right frontoparietal portion) adjacent to the coronal suture. There is a considerable loss of bone in the area where the bullet exited, with multiple fractures extending from the defect. In the photographs, part of the perimeter of the 2.5 centimeters, beveled exit hole is visible along the margin of the defect and is somewhat larger than the diameter of the bullet itself. On the basis of these photographs and simulated skull reconstruction, the panel was able to determine the location of the point of exit within a reasonable margin of error.



### *Deficiencies in the autopsy*

(474) The panel unanimously concluded that the deficiencies of the autopsy contributed to the uncertainty over the locations of the entrance and exit wounds in the head. The pathologists did not describe the wounds with reference to fixed body landmarks, nor did they examine the brain adequately. The panel itself was unable to examine the brain because it is among certain autopsy materials which are unaccounted for. The majority of the panel is satisfied that the select committee made a diligent though unsuccessful, effort to locate these missing materials. The majority of the panel believes that examination of the materials would fully support its conclusions.

(475) The panel discussed the methods for and difficulty of determining the trajectory and origin of the missiles. It notes that inherent in the procedures is a margin of error because of (1) the difficulty of establishing the precise angles of the missile tracks through the President's head and body, and (2) the difficulty of knowing the exact time of impact and the exact position of the body at the time of impact. These problems are greater for the bullet passing through the President's back and neck because it is less clear exactly when it struck the President. The impact to the head appears clearly in the Zapruder film, and its timing has therefore been determined with a high degree of accuracy.

(476) As the panel noted, the locations of both sets of entrance and exit wounds are approximations and are less precise than can often be made. The autopsy pathologists used nonfixed body landmarks such as the mastoid process\* to locate the wounds. The location of these landmarks will change with movement of the body; hence, the measurements to the wounds will vary depending on the position of the body when the measurement is taken.

(477) The position of the body itself when the bullets struck also affects the relationship of the entrance and exit wounds and the trajectory of the missiles. For example, if the President were moving his head to the left or right, the location of the entrance would relative to the landmarks used as reference points by the autopsy pathologists would vary. Similarly, the relationship of the exit wound to the entrance wound and the angle of the missile trajectory prior to striking the body would differ substantially.

(478) Finally, the autopsy doctors failed to dissect the upper back missile track. The panel is, therefore, unable to determine conclusively whether the missile's path was in a straight line from entrance to exit and whether this injury would necessarily have been fatal.

(479) The panel considered the value of disinterring the President's body to locate more precisely the various wounds and their relationships to one another and the pathways of the missiles. The majority concludes that an examination of the body would fully support its conclusions and thus would not further its investigative goals. Consequently, the majority of the panel decided against recommending disinterment.

### *Second head wound*

(480) When questioned by panel members, the autopsy pathologists stated that the piece of brain tissue on the lower rear of the head just above the hairline covered the entrance wound they described in their

report. The majority of the panel concludes, however, that the brain tissue actually lies on top of the hair and does not obscure a wound of any kind. If the brain tissue were obscuring a wound, the X-rays of the underlying skull would show evidence of wound damage, as would the photographs of the brain. There is no such evidence.

(481) Dr. Wecht raises the possibility of a tiny wound of entrance or exit being present beneath the white piece of brain that would not necessarily show up in the X-rays or the photographs of the brain. Dr. Wecht is also unwilling to rule out the possibility of another wound having occurred almost simultaneously with the area of the defect in the right front of the head without examining the brain.

(482) The other panel members believe that a near simultaneous wound from another shot, occurring at the instant when the skin and underlying bone are separated as a result of the known shot, is unfounded speculation. We believe strongly that another missile did not enter the right front of the head within the area of the large defect. We find no evidence supporting this speculation in the photographs of the head or brain, or in any of the X-rays of either adjacent bone fragment or the left side of the head where, in such an event, one might expect such a missile to lodge. No other missile was found, and the majority knows of no bullet that would completely disintegrate on hitting the soft tissue of the brain, as Dr. Wecht suggests.

(483) The majority also points out the following excerpt from Dr. Wecht's testimony in public hearings before the select committee on September 7, 1978. He said that there is "[v]ery meager" evidence to support his minority view, that there is an "extremely remote" possibility that the President was shot in the head by a second bullet from the side or front. Later in his testimony he reiterated his position:

Mr. PURDY. Dr. Wecht, does the present state of available evidence permit the conclusion that to a reasonable degree of medical certainty there was not a shot from the side which struck the President?

Dr. WECHT. Yes, with reasonable medical certainty I would have to say that the evidence is not there. I have already said it is a remote possibility and I certainly cannot equate that with reasonable medical certainty. (91)

(484) The issue of a second bullet striking the head from the front or side originates in part from the pronounced backward and leftward motion of the President's head and shoulders after being shot, as seen in the Zapruder film. To some, this motion appears explainable only by a shot coming from the front or side.

(485) The majority of the panel believes that there is a possibility that this movement may have been caused by neurologic response to the massive brain damage caused by the bullet, or by a propulsive effect resulting from the matter that exited through the large defect under great pressure, or a combination of both. Whatever the cause of the President's movement, the majority of the panel concludes that only one bullet struck the President's head and that it entered at the rear and exited from the right front.

#### *Governor Connally's wounds*

(486) The majority of the panel concludes that the evidence on the nature of the wounds suffered by Governor Connally to his torso, wrist



and thigh provides strong support for the conclusion that the wounds were caused by one bullet. The ovoid shape of the entrance wound on Governor Connally's back, described by one of the doctors at Parkland Hospital who treated the Governor, was most probably caused by a yaw\* or tumble\* in the flight of the bullet, which was deviating from its normal flight characteristics and path because of passing through President Kennedy. The majority does not feel, however, that the evidence is sufficient to eliminate entirely the possibility that the wobble was caused by a different intervening object.

(487) The medical evidence alone does not provide the panel with sufficient information to state with absolute certainty that the bullet that struck Governor Connally was the same one which had previously struck President Kennedy in the upper right back, exiting through his neck. The majority believes, however, that the medical evidence is consistent with this hypothesis and much less consistent with other hypotheses. Further, the panel considered other nonmedical evidence that strongly indicates that a single bullet injured both men. This evidence includes: The position of the two men, as shown in the Zapruder film; the fact that the two men can be alined consistent with the trajectory of one bullet; photographs of the seat locations in the limousine; the actual distortion of the so-called "pristine bullet"; the failure to recover any other bullet from the limousine or body; ballistics studies of the ammunition involved; and the results of neutron activation analysis of the bullet fragments conducted by Vincent P. Guinn, Ph. D. (These factors are discussed in the reports of other expert panels convened by the select committee.)

(488) The panel notes the interval between the observable reactions of the President and the Governor at the time of their injuries, as seen in the Zapruder film. Some observers have contended that the interval is too long to permit the conclusion that a single bullet struck both men.

(489) The majority of the panel believes that the interval is consistent with the single-bullet theory. At issue is the time delay between bullet impact and the observable reactions of each man to his injury, which in turn is determined by many factors, including whether or not their reactions were voluntary or involuntary. If involuntary, they would have occurred almost simultaneously with the injuries. If voluntary, there is often a slight delay in reacting.

(490) The first visual evidence that the President was struck was the movement of his hands to a position in front of his neck and his facial expressions. The majority of the panel construes these movements to have been voluntary, although it recognizes that they could have been involuntary had the bullet caused sufficient shock to his spine and spinal cord. The majority cannot say definitely, based on the available evidence, whether this more serious injury occurred and precisely when the President was struck.

(491) Similarly, the panel cannot determine precisely when Governor Connally was struck from either the medical evidence or his reactions as seen in the film: the puffing of his cheeks and the dropping of his shoulders. The majority believes that the nature of his injuries could have resulted in a voluntary motion, which would mean a delayed reaction. Thus, the majority believes that there could have been suffi-



cient delay in Governor Connally's reaction to account for the interval seen in the film and to permit the conclusion that a single bullet injured both men, notwithstanding its inability to determine whether President Kennedy's reaction was voluntary or involuntary.

(492) Panel members have differing views as to how soon Governor Connally would be expected to drop the hat he was holding in his right hand following the injury to his right wrist, but generally agree that there is little empirical data on which to determine with confidence what specific reaction should be expected from this type of wound.

#### *Autopsy procedures*

(493) As noted earlier, the panel unanimously concludes that the autopsy was faulty for a number of important reasons, some of which contributed to the speculation and controversy concerning the medical evidence. The panel believes that many of the difficulties are a result of inexperience with or neglect of the standard procedures which should be followed in forensic autopsies. The purpose of the medicolegal autopsy, as described in detail elsewhere in this report, is to answer anticipated or actual questions about the manner of death and to document the findings and answers in such a way that independent examiners may review the findings and procedures and reach their own conclusions.

(494) The panel urges unanimously that procedures such as those outlined elsewhere in this report be adopted as a model to be followed in the event of the suspicious death or obvious homicide of high Government officials.

PART IV: CRITIQUE OF THE EARLIER EXAMINATION, WITH PRESENTATION OF SUGGESTED PROCEDURES TO BE FOLLOWED IN PERFORMING AN INVESTIGATION AND EXAMINATION ON THE REMAINS OF A GUNSHOT VICTIM

INTRODUCTION

(495) The members of the forensic pathology panel were asked to comment on the post mortem examination conducted by the pathologists, Dr. Humes, Boswell, and Finck, including the procedure and the report prepared afterwards.

(496) According to a summary report prepared by Drs. Humes, Boswell, and Finck pursuant to requests by the Department of Justice following a meeting on January 20, 1967, at the office of Dr. Robert H. Bahmer, Archivist of the United States, (92) then-Commander Humes was directed to perform the autopsy by the Surgeon General of the U.S. Navy because of the decision to bring the body of the late President to the Naval Medical Center in Bethesda, Md., where Dr. Humes was Director of Laboratories. According to the summary, the Surgeon General of the Navy advised Dr. Humes "to determine the nature of the President's injuries and the cause of his death. (93)

(497) The same record indicates that the autopsy began at approximately 8 p.m. on Friday, November 22, 1963, and was concluded at approximately 11 p.m. The autopsy report, written by Dr. Humes with the assistance of Drs. Boswell and Finck, was prepared the morning of November 23 and delivered by Dr. Humes to Admiral Burkley, the President's physician, on November 24 at about 6:30 p.m.

(498) The Navy "Clinical Record Authorization for Post Mortem Examination, U.S. Naval Hospital, Bethesda, Md.," dated November 22, 1963, indicates the following:

2. You are hereby authorized to perform a complete post mortem examination on the remains of John F. Kennedy. Authority is also granted for the preservation and study of any and all tissues which shall be removed. This authority shall be limited only by the conditions expressly stated below: [no restrictions are indicated] Signature: [Mrs.] John F. Kennedy [typed]; Address: White House, Washington, D.C.; Authority to consent: wife [no signature is present]. The performance of the autopsy specified above is approved: R. O. Canada, Captain MC USN; Title: Commanding Officer; Date: 22 November 1963 [no signature in this location either]. (94) Signature of witness: Robert Kennedy.

On the bottom of this document is a block designated "Patient's Identification (for typed or written entries give: name—last, first, middle; grade; date; hospital or medical facility) is the signature "G. G. Burkley, Physician to the President." (95)

(499) The autopsy doctors had the following qualifications, as detailed in their report on their 1967 review of the autopsy photographs and X-rays:

In charge was James J. Humes, M.D., at the time commander, Medical Corps, U.S. Navy, and Director of Laboratories, Naval Medical School. He was certified in 1955 by the American Board of Pathology in anatomic and clinical pathology. Assisting him were J. Thornton Boswell, M.D., and Pierre A. Finck, M.D. Dr. Boswell at that time was a commander in the Medical Corps, U.S. Navy, and Chief of Pathology, Naval Medical School. He was certified in 1957 by the American Board of Pathology in anatomic and clinical pathology. Dr. Finck, a lieutenant colonel, Medical Corps, U.S. Army, was then chief of the Military Environmental Pathology Division and Chief of the Wound Ballistics Pathology Branch, Armed Forces Institute of Pathology, Walter Reed Medical Center. He was certified in 1956 by the American Board of Pathology in anatomic pathology and in 1961 in forensic pathology. (96)

(500) In his testimony before the Warren Commission, Dr. Humes characterized his experience as follows:

My type of practice, which fortunately has been in peacetime endeavor to a great extent, has been more extensive in the field of natural disease than violence. However, on several occasions in various places where I have been employed, I have had to deal with violent death, accidents, suicides, and so forth. Also, I have had training at the Armed Forces Institute of Pathology, I have completed a course in forensic pathology there as part of my training in the overall field of pathology. (97)

(501) When asked what his specific function was in connection with the autopsy, Dr. Humes responded as follows:

As the senior pathologist assigned to the Naval Medical Center, I was called to the center by my superiors and informed that the President's body would be brought to our laboratories for an examination, and I was charged with the responsibility of conducting and supervising this examination; told to also call upon anyone whom I wished as an assistant in this matter that I deemed necessary to be present. (98)

(502) Dr. Humes said he selected Dr. Boswell as one of his assistants and, later, Lt. Col. Pierre Finck, who was made available to him by Brigadier General Blumberg, the commanding officer of the Armed Forces Institute of Pathology, because "I felt it advisable and it would be of help to me to have the services of an expert in the field of wound ballistics and for that reason I requested Colonel Finck to appear. (99)

(503) Many of the difficulties that arose in relation to the post mortem examination or autopsy developed in part because of the basic differences between an autopsy conducted in a hospital pursuant to



the wishes of the next of kin and one conducted under the aegis of a medicolegal investigative system, pursuant to statute, for official purposes. The investigation of a death that is known or suspected to be unnatural is a multidisciplinary effort, requiring cooperation amongst a number of scientific disciplines and ongoing communication between those disciplines from the initiation of the investigation until its completion. The medicolegal autopsy is only one stage of this investigation, albeit an important one. To be performed properly, it requires that the prosecutor evaluate information obtained from those aware of the circumstances of the death and that the prosecutor anticipate and address questions which might arise subsequently.

(504) In a suspicious death, the body is initially the property of the State (state's evidence), and the autopsy is usually, if not invariably, conducted in accordance with a statute, in anticipation that the evidence gathered as a result of the procedure may be introduced into a civil or criminal proceeding. Such an examination is conducted without the consent of surviving members of the family who, on completion of the examination, assume custody of the body and make final disposition.

(505) Traditionally, the hospital pathologist conducts the examination in a hospital setting, invariably pursuant to the wishes of the family. Such an examination is concerned primarily with pathologic appraisal of the clinical diagnosis for which the physician was attending the patient, with evaluation of the treatment afforded the patient, and, in a more general sense, with the education of the medical community concerning the interrelationship between morphologically recognizable disease and the manifestation of this disease in the patient while alive. Such a procedure is also conducted in order to understand the development (pathogenesis) of the one or several diseases that the deceased person may have had, commencing with the identification of the causative (etiologic) agent or process responsible for initiating the disease, and continuing through the primary and subsequent secondary changes in the body incident to this disease. This usually culminates with an understanding as to which disease processes were immediately responsible for the patient's death. Correlation of the clinical presentation of the patient while alive with the disease processes identified at the autopsy is the responsibility of the traditionally trained hospital pathologist, who usually commences this procedure with a thorough review of the medical history of the deceased and with consultation with the attending physicians in an attempt to define the "problems" or questions to be answered during this type of procedure.

(506) The medicolegal autopsy, on the other hand, addresses itself to a number of different problems, although it has a number of features in common with the traditional hospital autopsy discussed above. The forensic pathologist conducting this examination has an educational background that initially is the same as the hospital pathologist's and includes a thorough understanding of natural disease processes, the manifestation of these diseases within the body and the correlation of these changes with clinical findings in the living person. He must also, however, fully understand the manifestations and ramifications of so-called "unnatural disease," that is, dis-

ease deriving from the effects of violence of all types, as well as other exogenous, unnatural agents on the body. The examination conducted by the hospital pathologist is designed to establish "clinical pathological correlation"—the relating of the medical illness to the findings of the autopsy. The forensic pathology examination is conducted after understanding the questions which have arisen in the course of the investigation prior to the autopsy and with anticipation of questions that might arise during or after the procedure. Such questions must be specifically addressed in the subsequent report.

(507) Such an investigation and examination should be conducted so that the observations and findings are objectively documented, before conclusions or opinions deriving from them are reached. Such documentation entails careful scrutiny, appropriate measurements, photography and use of any other means to make the observations and findings of the initial procedure available to professionals in the same or related fields whose expertise might be sought for further evaluation, or for review by other physicians in the event of criminal or civil litigation. Therefore, the medicolegal autopsy is conducted not only as a problem-oriented procedure that addresses itself to questions raised or anticipated, but also as a procedure that attempts to document the answers to these questions in such a way that other independent experts may review the findings and reach their own conclusions. The procedure is conducted in a systematic sequence, and a number of examinations by several different disciplines may be conducted concurrently.

(508) The general steps of any medicolegal investigation might be summarized as follows:

(509) 1. Careful scrutiny of the scene of death, with collection and preservation of evidence gathered, whether or not it is immediately apparent that it has a bearing on the evaluation of death. Such an investigation naturally includes careful documentation, not only by photography, but also by detailed report, from which a subsequent evaluator may be able to reconstruct independently the circumstances of death. If there is any possibility that the victim may survive, the body is moved from the crime scene prior to this examination by the investigator. Even then the subsequent investigation and documentation should be as thorough as is reasonable.

(510) 2. The medicolegal autopsy. This procedure begins after members of the team responsible for the onscene investigation have been consulted. The examiner should be familiar with the evidence derived from it and from all of the other individuals who may have had contact with the body of the victim subsequent to injury, with detailed collection of information concerning artifacts which may have been introduced onto or into the body incident to therapeutic management. The medicolegal autopsy in every instance should address itself to establishing the cause of death beyond a reasonable doubt and the elimination of other competing causes of death, these being criteria for presentation of such evidence in a criminal proceeding. The medicolegal autopsy is intended to be a complete examination which minimizes speculation.

(511) In a gunshot homicide, there are other specific questions, in addition to the above, which the examiner should address, including:



1. The identification, characterization, and localization of all wounds of missile entrance (inshoot), and the identification, characterization, and localization of all wounds of exit (outshoot).

2. The correlation of individual entrance and exit wounds, examination of the internal bullet track, the structures penetrated or perforated, and the extent of resulting injury.

3. The evaluation, if possible, of the lethality of individual wounds, the expected survival period, and the capability and extent of physical activity after injury.

4. The evaluation, if possible, of the sequence of individual wounds from observations on and in the body.

5. The determination of the cause of death and the exclusion of other antecedent and competing conditions.

### *The medicolegal examination*

#### *1. Physical facilities*

(512) The pathologist conducting the procedure should have access to facilities that will allow all team members to proceed in an orderly systematic fashion, without undue pressures, to complete the examination successfully and collect all of the necessary evidence in an expeditious manner. Included among equipment which should be available are examining and washing facilities and instruments, equipment for color, and black and white photography, X-ray equipment, and recording equipment to enable onsite observation and description of the findings.

#### *2. Personnel*

(513) Among the members of the team who should be available for consultation in examination of a gunshot victim are:

a. A radiologist and technical assistant to take and evaluate X-rays prior to commencement and during the procedure, if necessary.

b. A representative from the physical evidence laboratory who should have appropriate containers and labels for collecting individual items of evidence for subsequent examination. Such evidence should be individually itemized, packaged, and sealed and the chain of custody maintained by appropriate receipts.

c. Representatives of such other professional disciplines as may be needed to assist in the identification. These may include a forensic odontologist and/or a forensic anthropologist.

d. A forensic toxicologist to assist in determining that specimens should be collected to rule out intervening or antecedent chemical conditions which might cause, contribute, or otherwise relate to the death.

e. An investigator from the onscene investigation team should be available to assist in correlating onscene findings with the ongoing autopsy findings.

(514) Considering the purposes and significance of a medicolegal autopsy, it is necessary that every attempt be made to have appropriate professional staff and physical facilities available, recognizing that such resources to vary from community to community. This is especially true when a medicolegal autopsy is conducted on the President



of the United States. The examination must be conducted without compromising professional or physical resources, even if there were contrary pressures in the interests of time or for some other expediency. The decision to perform an autopsy should take into consideration the wishes of the family, and the necessity and requirements of the procedure should be explained to the family as sensitively as possible, but the forensic pathologist must retain final decisionmaking authority and responsibility as to whether an autopsy should be performed and its scope.

### *3. Details of the procedures*

(515) The individual steps that should be followed in the course of such procedures and the reasons for these steps include the following:

a. Examine exterior to body, clad, as received. Look for any abnormalities and other signs of cause and manner of death.

b. Photograph body overall as received. These photographs will aid in the documentation of the chain of custody and serve to refresh the memory of the investigator and examiner.

c. Search for and remove special items of evidence and individually package and label. Undress the body carefully and air dry clothing. Control samples of hair, et cetera, for comparison with similar evidence recovered from a suspect should be collected at this time. Trace evidence may provide clues to identify the assailant and/or help rule suspects in or out. It may also assist in identifying the scene of death or the location of the body, if moved after death.

d. Examine exterior of body, unclad. Look for evidence of violence.

e. Describe clothing, indicating general nature, defects due to violence of any type, their location, size (in centimeters) and approximate location (in centimeters, from fixed landmarks). Clothing defects may provide valuable clues about the cause and manner of death, as well as the events leading to death.

f. Photograph external unusual features of the body as received, with body landmarks. Diagrams of involved areas may also be important. These photographs may aid in documentation of the chain of custody and serve to refresh the memory of the investigator and examiner and may reveal features not noted previously.

g. At this point, careful cleaning of the body may be undertaken, with particular care to insure that significant external manifestations of trauma, et cetera, are not altered or removed. The cleaning of the body so as to rid it of excess blood, grease, and the like, is necessary to permit proper external examination. The removal of dirt, drainage, and debris may afford better visualization of external injury. The time delay associated with these procedures may allow for the settling of blood by gravity (dependent lividity) and thus afford better delineation of poorly defined bruises.

h. Describe natural external features of the body. This procedure is a normal part of the medicolegal autopsy and is vital for victim identification.

i. Describe unusual identifying marks, scars, and tattoos if present. Describe unnatural external features of body (external evidence of injury).

j. Size, shape, color, and location (both to fixed body landmark, such as above the heel or gluteal fold, or below the top of the head, and relationships to each other) of each gunshot entrance and exit wound should be noted, along with the diameters of wound, residues, abrasions, et cetera. The size and shape of the wound and surrounding residue may be compared with test patterns fired with the same or a similar weapon. Distances of the defects above the floor, ground or a seat may be used for reconstruction by triangulation.

k. Photograph face of body from the front, with identification number. This photograph can establish identity in court. Photograph unusual identifying features of body (tattoos, scars, et cetera.)

l. Photograph the closeup appearance of gunshot entrance and exit wounds, including wound residues from the gunshot and missile, with landmark and ruler in the photograph. Reconstruction of the measurements of wounds, their relationship and surrounding residues would be possible from such a photograph, in the event the voice recorded report or other notes are lost. These may also serve as illustrations in court to indicate the procedures used to determine the range of the weapon from the body.

m. Photograph all unusual external features of the body after cleaning, using body landmarks and an identifying number and ruler if necessary. The hair should be shaved around wounds prior to this final series of photographs. The examiner must remember that proper photographs take time. These photographs document the descriptive report.

n. X-ray the body as appropriate. X-rays may establish the presence of a bullet within the body and indicate its location. Removal of all the bullets is imperative for subsequent examination. X-rays also provide documentation for court.

o. Open the body cavities to inspect organs in their natural position (in situ). Internal evidence of injury should be noted and not be obscured by careless organ removal.

p. Collect specimens for appropriate toxicologic and serologic examination.

1. Blood.

2. Urine.

3. Other samples, as indicated, after consultation with the toxicologist. Blood should be collected from the heart and/or a large, more peripheral artery or vein, and labeled accordingly. Urine should be collected free of contamination. Vitreous humor from the eye may also be of toxicologic value.

q. Collect samples for serology. Serologic typing of the victim's blood may provide important information for comparison with blood stains found on the alleged assailant or at the scene.

r. Describe internal evidence of injury, and effects of medical or surgical therapy, if any. Photograph any internal evidence of injury or therapy in situ and after dissection. These photographs document the descriptive report.

s. Describe internal evidence of injury and distinguishing abnormalities due to hospital treatment. Again, descriptions must be thorough, accurate, concise, and logically ordered.

t. Photograph internal evidence or organ injury dissected. Of value may be photographs of the body from sagittal and coronal locations, with rigid probes in place to indicate angles of bullet tracks. These may be used to measure more accurately the angles of the bullet track(s), to remeasure these angles in the event the voice recorded report or notes are lost, or for court illustration.

u. Describe internal natural findings. The pathologist should note evidence of natural disease, as it may be relevant to a traumatic death.

v. Collect representative sections of unusual pathologic findings from appropriate organs and samples of all organs for histopathologic examination. This is the standard procedure for all well-conducted autopsies and is not unique to a forensic autopsy.

w. Retain appropriate gross organs as necessary and appropriate for illustration for the attending physician or as subsequent evidence in criminal or civil proceedings. In those cases in which there is known or suspected injury or disease of the brain, supplemental examination with sectioning should be conducted after 10-14 days of fixation (usually in formalin).

x. Photograph significant findings on dried clothing, with identifying number and ruler. Individually package significant portions and seal and label. Individual packaging will prevent cross-contamination with other articles of clothing and will aid in documenting the chain of custody.

y. Bag all clothing. Clothing helps in preserving the chain of custody and in avoiding contamination.

z. Fingerprint body for definite and independent identification.

aa. Complete the description of findings and conclusions concerning the cause and manner of death. The final report should be completed promptly after all pertinent examinations are finished. The opinions and conclusions of this report should attempt to interpret subtle medical findings and anticipate questions of lay readers.

bb. Submit collected specimens to the forensic physical science laboratory, maintaining a proper chain of custody.

#### *Specific considerations pertaining to the John F. Kennedy autopsy*

(516) The panel evaluated some of the major difficulties encountered during and after the Kennedy autopsy and the reasons for these difficulties, in addition to those which might have been encountered had a defendant allegedly responsible for this crime been placed on trial within the jurisdiction where the crime occurred.

#### *1. Jurisdiction*

(517) Chapter 49 in the Code of Criminal Procedure in the State of Texas details the responsible authorities and procedures for "Inquests upon dead bodies." (100) Article 49.01, entitled "When Held," states: "It is the duty of the justice of the peace to hold inquests, with or without a jury, within his county in the following cases \* \* \*" (101) Paragraph two lists these cases, among others: "When any person is killed, or from any cause, dies an unnatural death, except under sentence of the law; or dies in the absence of one or more good witnesses." (102) Paragraph four includes: "When the circumstances of the death of any person are such as to lead to suspicion that he came to his death



by unlawful means.”(103) The same section also contains this statement: “The inquests authorized and required by this article shall be held by the justice of the peace of the precinct in which the death occurred.”(104)

(518) Article 49.03, entitled “Autopsies and Tests,” states the following concerning an inquest held to ascertain the cause of such death:

The justice of the peace shall in all cases call in the county health officer, or if there be none or if his services are not then obtainable, then a duly licensed and practicing physician, and shall procure their opinions and advice on whether or not to order an autopsy to determine the cause of death. If, upon his own determination he deems an autopsy necessary, the justice of the peace shall, by proper order, request the county health officer, or if there be none or if it be impracticable to secure his services, then some duly licensed practicing physician who is trained in pathology to make an autopsy in order to determine the cause of death, and whether death was from natural causes or resulted from violence, and the nature and character of either of them.(105)

(519) The record of inquest details that the formal inquest on John Fitzgerald Kennedy was held on November 22, 1963, at 1 p.m., at Parkland Memorial Hospital in Dallas, Tex., and that the date of death was November 22, 1963, at Parkland Hospital.(106) The “Nature of Information given J.P.” was “Death as a result of two gunshot wounds of head and neck.”(107) The document states that the information was provided by Dr. Malcolm Perry, M.D., Parkland Memorial Hospital, Dallas, Tex.(108) It also contains the official “Findings by the Justice:”

I, Theran Ward, justice of the peace, precinct No. 2, Dallas County, Tex., after viewing the dead body of John Fitzgerald Kennedy and hearing the evidence, find that he came to his death as a result of multiple gunshot wounds of the head and neck. With this, my hand, officially, this the 10th [sic] day of November A.D. 1963, Theran Ward, justice of the peace, precinct No. 2, Dallas County, Tex.(109)

(520) Thus, the Texas statute in effect at that time placed the responsibility for determination of the cause of death with a layman, the justice of the peace, who might consult the county health officer and might order an autopsy by a qualified pathologist, if deemed necessary, “to determine the cause of death.”(110)

(521) Other than the official record of inquest, which states specifically that Ward did, in fact, view the remains of President Kennedy, there is no record of a formal inquest or other procedure to gather evidence from the body within the territorial jurisdiction of death. Nor does the record indicate whether Ward was consulted prior to removal of the body from Dallas County, Tex., for which the President’s personal physician, Admiral Burkley, was responsible. If such was the case, the authority to approve an autopsy subject to the wishes of the next of kin in Bethesda was a legal order, and evidence obtained as a result of that procedure undoubtedly would have been admissible in a subsequent criminal procedure. If he was not consulted and chose

to make an issue of his responsibilities and their abrogation by authority other than himself, and had criminal litigation ensued, a duly constituted court in the State of Texas might have found legal problems to be associated with the criminal proceeding.

(522) The record of inquest signed by Ward was dated November 10, antedating the assassination of the President by some 12 days. The panel concludes that the document is in error and that the correct date of issue most probably was December 10, some 18 days after assassination of the President.

(523) The official certificate of death, signed by Ward on December 6, 1963, records the "Findings by the Justice" as follows:

I, Theran Ward, justice of the peace, precinct No. 3, Dallas County, Tex., after viewing the dead body of John Fitzgerald Kennedy and hearing the evidence find that he came to his death as a result of two gunshot wounds (1) near the center of the body and just above the right shoulder, and (2) 1 inch to the right center of the back of the head. Witness my hand, officially, this the sixth day of December A.D. 1963, Theran Ward, justice of the peace, precinct No. 3, Dallas County, Tex.

On the same document is the official recording:

I, Theran Ward, a justice of the peace, in and for Dallas County, Tex., do hereby certify that said inquest was held before me, on the day mentioned, and the proceedings in said inquest, as described above are correct. (s) Theran Ward, justice of the peace, precinct No. 3. (111)

## *2. Pathologists conducting the autopsy*

(524) As his Warren Commission testimony indicates, Commander Humes was selected to perform the post mortem examination because he was the senior pathologist at the U.S. Navy Medical Center in Bethesda, where the President's body was taken at Mrs. John F. Kennedy's request. (112) His testimony further indicates that Commander Humes was directed to seek assistance from any individual of his choosing, recognizing the distinct difference between the background and training of an individual regularly employed in hospital practice and one trained in forensic pathology. (113) As Commander Humes stated to the Warren Commission, his training in forensic pathology was limited to a course "at the Armed Forces Institute of Pathology," and his experience was limited to "several occasions in various places where I have been employed (where) I have had to deal with violent death, accidents, suicides, and so forth." (114)

(525) The panel concludes that the assistance of experienced pathologists engaged in the full-time practice of forensic pathology, not merely in a consulting or review capacity (such as was the experience of Lieutenant Colonel Finck), would have materially assisted in the proper performance of this autopsy.

## *3. Secrecy during and following the autopsy*

(526) A memorandum directed to Commander Humes and his associates by Capt. John H. Stover, dated November 25, 1963, officially reminded the physicians of his earlier verbal admonition that they not

discuss any of the procedure or findings with anyone unless with his specific authorization. Lieutenant Colonel Finck, in his letter to J. M. Blumberg dated Feb. 1, 1965, recalled this admonition:

After the completion of the post mortem examination, the Surgeon General of the Navy told us not to discuss the autopsy with anyone, even among prosecutors or with the investigators involved. (115)

This directive prohibiting communication, even with "the investigators involved," would certainly impede a proper medicolegal investigation and timely preparation of an accurate report.

#### 4. Completeness of the autopsy

(527) As stated earlier, a complete medicolegal autopsy is necessary not only to determine the exact cause of death and to gather other evidence that might be of value in identifying the manner of death, but also to rule out other or contributing causes. Commander Humes has indicated on record and before this panel that he was not advised of any restrictions on the performance of a complete autopsy. Dr. Finck indicated the contrary during a trial in New Orleans, La., on February 24, 1969. This was the trial of the *State of Louisiana v. Clay L. Shaw*, that resulted from the investigation of New Orleans District Attorney Jim Garrison into the possibility that Clay Shaw and others conspired to kill President Kennedy. In connection with the medical inquiry in this trial, Finck had been called to testify and was asked, "Why did you not dissect the track of the bullet wound that you have described today and that you saw at the time of the autopsy at the time that you examined the body? Why? I asked you to answer that question." Dr. Finck replied: "As I recall I was told not to, but I don't remember by whom." Question: "Could it have been one of the admirals or one of the generals in the room?" Answer: "I don't recall." Question: "Do you have any particular reason why you can't recall at this time?" Answer: "Because we were told to examine the head and chest cavity, and that doesn't include the removal of the organs of the neck." (116)

(528) Dr. Finck, in his letter further detailed his understanding of the restrictions:

After the publication of the Warren report, numerous physicians criticized the autopsy protocol that did not describe the adrenal glands of Kennedy who suffered from adrenal insufficiency. The prosecutors complied with the autopsy permit and its restrictions. I was told that the Kennedy family first authorized autopsy of the head only and then extended the permission to the chest. Organs of the neck were not removed, because of the same restrictions. I feel that the prosecutors accomplished their mission that was to determine the direction of the shots and the cause of death. (117)

(529) He further noted the restrictions of the procedure as he understood them: "The organs of the neck were not removed: The President's family insisted to have only the head examined. Later, the permission was extended to the chest." (118) He also states:

On Sunday, November 24, 1963, I went to the naval hospital to help Commander Humes who had written an



autopsy report. Humes, Boswell, and Finck, the three prosecutors, signed the autopsy report in the office of Admiral Galloway. (I had suggested several corrections in the autopsy report. While we were checking the autopsy report in the admiral's office, the television announced the murder of Oswald by Ruby.)

In my discussion with Commander Humes, I stated that we should not check the block "complete autopsy" in the autopsy report form. In compliance with the wishes of the Kennedy family, the prosecutors had confined their examination to the head and chest. Humes declared that the block "complete autopsy" should be checked. (119)

(530) Lieutenant Colonel Finck also indicated:

I was denied the opportunity to examine the clothing of Kennedy. One officer who outranked me told me that my request was only of academic interest. The same officer did not agree to state within the autopsy report that the autopsy was not complete, as I had suggested to indicate. I saw the clothing of Kennedy, for the first time on March 16, 1964, at the Warren Commission, before my testimony, more than 3 months after the autopsy. (120)

(531) Commander Humes indicated to the panel that during the autopsy Admiral Galloway ordered that the procedure be a complete examination. As indicated in section III of the panel's report, the autopsy report acknowledged removal and description of thoracic and abdominal organs, but not of neck organs. Likewise, the forensic pathologist on the team, Dr. Finck, the individual who might have observed changes on the clothing which would characterize entrance and exit wounds, did not have access to this evidence, apparently because the senior pathologist, Dr. Humes, did not have the experience or education to be aware of the value of such an examination.

(532) As indicated elsewhere in this report, the panel members also took note of the failure to include the description of certain organs, including the adrenal glands, within the body of the autopsy report. The panel members are divided in their opinion as to the propriety of this omission in a public report, but all agree with the need to maintain permanent records of such observations in the event that there is need to provide them in subsequent criminal litigation.

(533) The panel also took note of the unavailability of the histopathologic sections and the brain, which had not hitherto been sectioned. The panel acknowledges the need for such evidence in subsequent criminal litigation and the adverse effect that failure to retain such evidence might have on the proper outcome of such litigation.

(534) The panel likewise took note of the failure to record properly the findings during the procedure, particularly the measurements of the location of the entrance wound in the head, or even to retain the original notes from which the final report was prepared for reasons stated by Dr. Humes before the Warren Commission. The panel

believes that the inability to examine such documentation in the event of a legal dispute could adversely affect the outcome of subsequent criminal litigation.

(535) Finally, prosecutors should have reviewed the preliminary report in conjunction with the photographs taken during the course of this procedure and prepared a more complete diagram which included critical measurements not otherwise recorded. By doing so they might have avoided a very obvious error in the location of the wound of entry in John F. Kennedy's head, as documented elsewhere in this report.

#### 5. *Examination procedure*

(536) The more serious procedural errors of the post mortem examination include the following:

(537) a. The body was moved out of the geographical area statutorily responsible for investigation of the death and autopsy. b. The pathologist(s) charged with performing the autopsy had insufficient training and experience to evaluate a death from gunshot wounds. They did not confer with the physicians who had treated the President at Parkland Hospital before commencing their examination and did not therefore realize that a bullet perforation in the neck had been altered by a tracheotomy procedure until after the body had been removed.

(538) c. The pathologists did not or could not control the circumstances at the time of autopsy to afford privacy to the remains and to work unimpeded by visitors.

(539) d. Proper photographs were not taken.

(540) e. The President's clothing was not examined by the pathologists.

(541) f. The autopsy procedure was incomplete:

1. The external examination did not take thorough note of all the wounds: The anterior neck exit wound was not noticed, the head entrance wound was not accurately located with reference to fixed anatomic reference points, and the head was not reconstructed in order to determine the precise location of the head exit wound.

2. The bullet track in the back and neck was not dissected, so the extent of injury to the neck structures was not evaluated and the course through the body not fully appreciated.

3. The angles of the bullet tracks through the body were not measured relative to the body axis.

4. The brain was not properly examined and sectioned.

(542) g. The autopsy report was incomplete, prepared without reference to the photographs, and was inaccurate in a number of areas:

1. The entrance head wound location was incorrectly described.

2. The entrance and exit wounds on the back and front neck were not localized with reference to fixed body landmarks and to each other so as to permit reconstruction of trajectories.

3. There was no description of the neck areas which were not dissected. Instead, the pathologists referred to the observations of the treating physician at Parkland (hearsay) and did not mention that they failed to detect the presence of the missile exit in the anterior neck.

4. There was no description of the adrenal glands or of other organs.  
(543) Resources available to conduct medicolegal autopsies vary tremendously in different sections of the country, with accompanying variation in the degree of sophistication of the examination and related ancillary procedures, such as odontology, toxicology, et cetera. The resources available for this autopsy, however, were extensive.

(544) The above list of deficiencies in the autopsy reflects only those gross errors which would have been avoided in most metropolitan medicolegal jurisdictions and which probably would have been avoided in this instance if a forensic pathologist with day-to-day experience in the investigation and examination of such deaths had been present at the autopsy.

(545) Despite the deficiencies of the postmortem examination of the President, the panel found that sufficient documentation was available for it to arrive at correct and valid conclusions, as stated in this report, as to the cause of death of President Kennedy and the precise injuries the President suffered.



PART V: SUGGESTED PROCEDURES TO BE FOLLOWED IN THE EVENT OF SUB  
SEQUENT ASSASSINATIONS OF FEDERAL OFFICIALS

(546) The panel has taken note of chapter 18 of the United States Code annotated, entitled "Presidential Assassination, Kidnaping, and Assault," enacted in 1965, which states:

SEC. 1751. Presidential assassination, kidnaping, and assault; penalties:

(a) Whoever kills any individual who is the President of the United States, the President-elect, the Vice President, or, if there is no Vice President, the officer next in the order of succession to the office of President of the United States, the Vice-President-elect, or any individual who is acting as President under the Constitution and laws of the United States, shall be punished as provided by sections 1111 and 1112 of this title.

(b) Whoever kidnaps any individual designated in subsection (a) of this section shall be punished (1) by imprisonment for any term of years or for life, or (2) by death or imprisonment for any term of years or for life, if death results to such individual.

(c) Whoever attempts to kill or kidnap any individual designated in subsection (a) of this section shall be punished by imprisonment for any term of years or for life.

(d) If two or more persons conspire to kill or kidnap any individual designated in subsection (a) of this section and one or more of such persons do any act to effect the object of the conspiracy, each shall be punished (1) by imprisonment for any term of years or for life, or (2) by death or imprisonment for any term of years or for life, if death results to such individual.

(e) Whoever assaults any person designated in subsection (a) of this section shall be fined not more than \$10,000 or imprisoned not more than 10 years, or both.

(f) The terms "President-elect" and "Vice-President-elect" as used in this section shall mean such persons as are the apparent successful candidates for the offices of President and Vice President, respectively, as ascertained from the results of the general elections held to determine the electors of President and Vice President in accordance with title 3, United States Code, sections 1 and 2.

(g) The Attorney General of the United States, in his discretion, is authorized to pay an amount not to exceed \$100,000 for information and services concerning a violation of this section. Any officer or employee of the United States or of any State or local government who furnishes information or renders service in the performance of his official duties shall not be eligible for payment under this subsection.

(h) If Federal investigative or prosecutive jurisdiction is asserted for a violation of this section, such assertion shall suspend the exercise of jurisdiction by the State or local authority, under any applicable State or local law, until Federal action is terminated.

(i) Violations of this section shall be investigated by the Federal Bureau of Investigation. Assistance may be requested from any Federal, State, or local agency, including the Army, Navy, and Air Force, any statute, rule, or regulation to the contrary notwithstanding. (121)

(547) Chapter 18, entitled "Congressional Assassination, Kidnaping, and Assault," also enacted since the Presidential assassination, states:

SEC. 351. Congressional assassination, kidnaping, and assault: penalties—

(a) Whoever kills any individual who is a Member of Congress or a Member-of-Congress-elect shall be punished as provided by sections 1111 and 1112 of this title.

(b) Whoever kidnaps any individual designated in subsection (a) of this section shall be punished (1) by imprisonment for any term of years or for life, or (2) by death or imprisonment for any term of years or for life, if death results to such individual.

(c) Whoever attempts to kill or kidnap any individual designated in subsection (a) of this section shall be punished by imprisonment for any term of years or for life.

(d) If two or more persons conspire to kill or kidnap any individual designated in subsection (a) of this section and one or more of such persons do any act to effect the object of the conspiracy, each shall be punished (1) by imprisonment for any term of years or for life, or (2) by death or imprisonment for any term of years or for life, if death results to such individual.

(e) Whoever assaults any person designated in subsection (a) of this section shall be fined not more than \$5,000, or imprisoned not more than 1 year, or both; and if personal injury results, shall be fined not more than \$10,000, or imprisoned for not more than 10 years, or both.

(f) If Federal investigative or prosecutive jurisdiction is asserted for a violation of this section, such assertion shall suspend the exercise of jurisdiction by State or local authority, under any applicable State or local law, until Federal action is terminated.

(g) Violations of this section shall be investigated by the Federal Bureau of Investigation. Assistance may be requested from any Federal, State, or local agency, including the Army, Navy, and Air Force, any statute, rule, or regulation to the contrary notwithstanding. Added Public Law 91-644, title IV, section 15, January 2, 1971, 84 Stat. 1891. (122)

(548) The panel considered these statutes and the method whereby a medicolegal autopsy would be conducted as a consequence of these statutes. Currently under a contingency plan developed by the Fed-

eral Bureau of Investigation in cooperation with the Armed Forces Institute of Pathology, the institute would cooperate in the selection of qualified individuals to assist in the examination.

(549) The panel is compelled to offer the following alternative, more viable procedures for consideration by the select committee.

(550) On the death of any of the officials designated in the two statutes, where it has apparently been caused or aggravated by any criminal act specified in this section, a complete and thorough post mortem examination and autopsy shall be performed on the dead body. No person, member of any government agency or otherwise shall forbid or interfere in any way with the performance of such an autopsy.

(551) Three or more physicians, each licensed to practice medicine in at least one State of the United States or, in lieu thereof, holding a commission in one of the armed services of the United States, shall perform this autopsy. Each of the physicians shall have been certified by the American Board of Pathology in the medical specialty of forensic pathology. In the event that the death has occurred within the jurisdiction of a medical examiner or coroner of any State or political subdivision thereof, the medical examiner or coroner may attend the autopsy, and in the event that he or she is a licensed doctor of medicine certified by the American Board of Pathology as specified above, will be designated to participate in the performance of the autopsy.

(552) The Attorney General of the United States shall designate the forensic pathologists who will perform the autopsy, on the advice and recommendation of the Director of the Armed Forces Institute of Pathology.

(553) Another alternative is to have all U.S. attorneys establish prior working relationships or standardized procedures with a medical examiner or coroner from their jurisdictions so that, if a death occurs in their jurisdiction, this person automatically participates in the autopsy. The medical examiner or coroner must be certified by the American Board of Pathology in the specialty of forensic pathology. The U.S. attorney and the previously designated medical examiner or coroner in the jurisdiction where death occurs will then designate the remaining forensic pathologists. In the event the death occurs outside the jurisdiction of any U.S. attorney, the Attorney General will then choose the forensic pathologists.

(554) One of the three or more physicians designated to perform the autopsy will be designated as the team leader and will be responsible for the preparation of the final report, with the concurrence of a majority of those participating in the autopsy. If the medical examiner or coroner in the community where the death occurred meets the designated qualifications, he will be the team leader. In the event that a material divergence of opinion arises between team members pertaining to an interpretation of a salient finding of the autopsy or subsequent laboratory testing of fluids or tissues from the body, a minority report may be prepared.

(555) Laboratories designated by the team leader will examine and document all material evidence unless such evidence is of the type that is customarily examined by crime laboratories, in which case the designated investigator from the FBI will designate the laboratory and will see that the evidence is properly transferred, with documen-



tation. No photograph taken of the body or its accouterments, or of any evidence removed from the body, will be destroyed; all should be retained as evidence, regardless of quality. All laboratory test results, all photographs, and all other evidence material to the determination of the events associated with the injury to the victim will be made available to the forensic pathology team as frequently as may be requested by its leader during the preparation of its reports. The forensic pathologist may also consult with laboratories and individuals apart from the FBI.

(556) On completion of all criminal court proceedings arising out of the prosecution of the person or persons responsible for the death under investigation, all physical evidence, including photographs, that can be preserved will remain the property of the United States of America and be preserved in the custody of the Archivist of the United States at the National Archives.

(557) The panel suggests that these procedures might be considered as the implementing rules or regulations to support section 1751 of title 18, but believes that they might also be incorporated into paragraph (h) of the existing legislation. This would preclude the development of a situation similar to that which existed at the time of the assassination of President Kennedy. Military medicine still does not acknowledge the need for a full-time medicolegal investigative system within its programs, but depends on pathologists, many of whom are not specifically trained in forensic pathology, to act as consultants to investigators, performing autopsies on request. These examinations are often performed without adequate interaction between the investigator and the pathologists, who frequently has not had appropriate training. As review of the findings of such investigations and examinations by the forensic pathology branch of the Armed Forces Institute is usually delayed, it is often too late to correct inadequacies of the investigation or examination which may result in inadequate documentation and interpretation of evidence in subsequent criminal or civil litigation.

DISSENTING VIEW PART VI: ADDENDUM TO THE FORENSIC PATHOLOGY  
PANEL REPORT,\* SUBMITTED BY CYRIL H. WECHT, M.D., J.D.

(558) The single-bullet theory (SBT) is unequivocally repudiated by an objective, thorough evaluation and analysis of all the medical, scientific, and physical data in the assassination of President John F. Kennedy (JFK).

(559) Despite the semantical sophistry and intellectual gymnastics of the forensic pathology panel report (FPPR), it is clear that the SBT can no longer be maintained as an explanation for the bullet wounds in JFK's back and neck, and all the bullet wounds in Gov. John B. Connally (JBC). The angles at which these two men were hit do not permit a straight line trajectory (or near straight line trajectory) of Commission exhibit 399 (the so-called magic bullet) to be established. Indeed, quite the opposite is true. In order to accept the SBT, it is necessary to have the bullet move at different vertical and horizontal angles, a path of flight that has never been experienced or suggested for any bullet known to mankind. I am submitting a sketch, marked Wecht exhibit 11, to demonstrate this point in graphic fashion.

(560) An examination of the physical relationship between JFK and JBC immediately prior to and immediately following the moment that their wounds are alleged to have been inflicted by Commission exhibit 399 (as required by the SBT) provides unquestionable evidence that the bullet could not have moved in the direction claimed by the FPPR. I am submitting several photographs, marked Wecht exhibits 1 through 6, which demonstrate this relationship.

(561) Wecht exhibit 6 shows JBC firmly clutching his hat. This is approximately 1½ seconds after he is alleged to have been shot through the chest, right wrist, and into his left thigh. Indeed, the FPPR states that they were surprised that although he had suffered the injury to his wrist, he did not drop his hat. The panel should not only be surprised, but incredulous. If they were not so slavishly dedicated to defending the Warren Commission report (WCR), and the previous opinions submitted by two of the panel members, Dr. James Weston and Dr. Werner Spitz, they would have interpreted this picture correctly and accepted it for what it obviously and clearly demonstrates—namely, that JBC was not struck in the chest, wrist, or thigh by CE 399, and the SBT is, therefore, indefensible.

(562) I do not accept the conclusion of the FPPR that the configuration of the gunshot wound on JBC's back indicates that the bullet that struck him at that location had to have been tumbling, and that such tumbling was most probably caused by the bullet (CE 399) having first gone through JFK's back and neck. There is strong evidence to indicate that the elongation of the wound on JBC's back was in the horizontal plane, and not in the vertical plane, which would be

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\*References to or quotes from the Forensic Pathology Report refer to drafts of the report.

consistent with the shot having struck JBC on a tangential angle from the right rear. Furthermore, if, in fact, the bullet that struck JBC was tumbling, such tumbling could just as easily have been caused by the bullet nipping a small tree branch or leaves during the course of its preimpact trajectory.

(563) With regard to this portion of the discussion, I should like to note for the record that the FPP and HSCA staff placed much emphasis on and gave a great deal of credence to so-called ballistics studies performed by Dr. John Lattimer, a urologist with no training, experience, or expertise whatsoever in forensic pathology. At the same time, the FPP and HSCA paid no attention whatsoever to the ballistics studies performed by Dr. John Nichols, a board-certified pathologist and full-time professor of pathology on the faculty of the University of Kansas School of Medicine. This is additional evidence of clearcut bias on the part of both the HSCA staff and the FPP.

(564) Examination of CE 399, correlated with various studies previously performed with identical ammunition fired from a Mannlicher-Carcano rifle, definitely proves that this bullet could not have inflicted all the damage attributed to it under the SBT to JFK and JBC. Specifically, there is no way that this bullet could have caused all the bone damage to JBC's right fifth rib and right radius, without having sustained more physical deformity.

(565) I am submitting pictures of CE 399 (Wecht exhibits 7, 8 and 9) to show that the only deformity of this bullet was minimal indentation at the base, with absolutely no damage to the nose of the bullet and no defects in the copper jacket.

(566) I am also submitting another picture (Wecht exhibit 10), which is a composite photograph of identical ammunition fired under the auspices of the Warren Commission in 1964. These other bullets were fired into cotton wadding, a goat carcass (breaking one rib of the goat), and the wrist of a human cadaver (breaking the distal end of the radius), respectively. They all showed more deformity than CE 399, especially the bullet that was fired through a human wrist. And yet, we are asked to accept the fact that CE 399 broke both a rib and a radius in JBC, and emerged intact and only minimally deformed at the base. This finding alone destroys the SBT in an objective, scientific manner.

(567) Despite repeated requests by me that further studies be performed on animal carcasses and human cadavers with 6.5-millimeter ammunition (copper jacket, lead core), the FPP members refused to go along with this very reasonable and logical request. It is clear to me that their reluctance was based upon their knowledge that such studies would further destroy the SBT.

(568) Similarly, I repeatedly requested that our panel be given access to JFK's brain, so that it could be properly examined. Although some members of the FPP did give affirmative lip service to this request, it was quite clear from their deliberations in the FPPR that they did not choose to emphasize and pursue properly this scientifically logical and reasonable demand.

(569) In this regard, with reference to both of my requests concerning test-firings through animal carcasses and human cadavers, and an attempt to locate and gain access to JFK's brain, I should like to note that there was also great reticence on the part of Prof. G. Robert



Blakey, chief counsel and director of the House Select Committee on Assassinations (HSCA), to undertake these pursuits. As a matter of fact, Professor Blakey did not seem the least bit interested in undertaking such studies. I wish to emphasize the fact that such controlled test-firings were performed at the request of the Warren Commission in 1964, and undoubtedly could have been repeated at this time with a reasonable expenditure of time, effort, and money.

(570) The FPPR states that: The panel considered the question that the residual defect might conceivably have been the location for an additional inshoot wound, but noted that there was no radiographic evidence of such a missile within the skull, nor any observation or description of the effects of such a missile on the skin flaps, within the brain, or interior of the skull.

(571) In my opinion, the medical evidence and other physical evidence and investigative data in this case do not rule out the possibility of an additional gunshot wound of JFK's head. This shot could have been fired in synchronization with the other shot that struck JFK in the back of the head, and would most probably have been fired from the right side (in relationship to the Presidential limousine).

(572) A soft-nose bullet, or some other type of relatively frangible ammunition, that would have disintegrated upon impact, could have struck the right side of JFK's head in the parietal region. Inasmuch as there is a large defect of JFK's skull in this area, it is not possible to rule out the existence of a separate entrance wound at the site. Since this kind of ammunition would not have penetrated deeply into the brain, there would be no evidence of damage to the left cerebral hemisphere, nor would there be fragments of such a missile deposited in the left side of the brain. Also, there would not be a separate exit wound if this kind of ammunition had been used.

(573) Again, it must be reemphasized that examination of JFK's brain is a critical element of this assassination investigation. It is truly incredible that appropriate dissection and examination of JFK's brain was not performed by the pathologists who did this autopsy on November 22, 1963, or at the time of their supplemental examination of the brain 2 weeks later on December 6, 1963. It is equally incredible, and most unfortunate, that the members of the FPP and HSCA staff have cursorily dismissed my frequent requests that JFK's brain be recovered and properly examined at this time. Their perfunctory dismissal of this obviously important and medically critical aspect of the investigation demonstrates without question their preconceived bias and professionally injudicious attitude vis-a-vis this case.

(574) The FPPR engages in a lengthy discussion to explain the basis for their conclusion that "Solely on the basis of others' descriptions of the wounds in Governor Connally's wrist and thigh, the panel could not rule out the possibility that these were caused by a fragment of the bullet striking the President's head, although the panel felt that the ability to align the wounds in the chest, wrist, and thigh, offered strong presumptive evidence that they were caused by one missile." I wish to take strong exception to this conclusion and express my unequivocal disclaimer to this so-called "presumptive evidence."

(575) The FPPR goes to great lengths to explain why it is not possible to draw straight lines through JFK and JBC in an attempt either to corroborate or disprove the SBT. Then, with incredible, intellectual inconsistency, the report nevertheless goes on to conclude that the SBT is physically possible and plausible. This blatant disregard of medical and scientific evidence and deliberate distortion and misrepresentation of analytical studies demonstrate more vividly than anything else the bias of my colleagues on the FPP.

(576) As further evidence of my allegation that the FPP began its deliberations with a preconceived bias vis-a-vis the WCR, I should like to point out in its report (first page of part 1), the statement that following its very first meeting at the National Archives on September 18, 1977, "it was disclosed that subpanel 1 was in unanimous agreement with respect to the interpretation of the evidence." (Subpanel 1 consisted of all the FPP members except Spitz, Wecht, and Weston.) And yet, when subpanel 1 met with subpanel 2 (Spitz, Wecht, and Weston), I pointed out many problems and emphasized various specific issues, other members of the overall FPP also expressed strong differences of opinion. This clearly demonstrates the strong, premature desire on the part of the FPP to rush headlong into another superficial whitewash of the WCR.

(577) I also wish to point out for the record that a meeting was arranged between subpanel 1 of the FPP and Drs. Humes and Boswell in Washington, D.C., during the time of their first meeting in September 1977. There is no question in my mind that this meeting was arranged by the HSCA staff and members of the FPP at that time in order to exclude me from participating in the discussion and interrogation of Humes and Boswell (two of the three pathologists who performed the autopsy on JFK on November 22, 1963).

(578) The FPPR does not adequately and definitively address itself to the numerous procedural and substantive deficiencies of the original autopsy and related medical-scientific investigative studies. The FPPR states that "Rather than proceed step by step with a critical review of the autopsy conducted by these individuals who were acting in response to official military orders under duress, with time and other constraints, the panel felt it wise to delineate some of the basic differences between a 'hospital autopsy' and a forensic autopsy performed as a necessary step in an official medicolegal investigation of death."

(579) I would like to have it noted as a matter of the official record that I never agreed to such an approach. I feel that a constructive, detailed, critical analysis of the JFK autopsy should most definitely be incorporated as a vital part of the FPPR. In fact, this objective was specifically set forth as one of the four charges addressed to the members of the FPP at the outset of the deliberations in September 1977 (see p. 2 of the FPPR). The panel was "to conduct a detailed objective critique of the professional manner in which the autopsy of President Kennedy was conducted."

(580) Once again, the FPP demonstrates more concern about the feelings, sensitivities and reputations of its personal friends and professional colleagues than it does about uncovering the ultimate truth involving the assassination of President John F. Kennedy. My exclusion from the above-mentioned meeting serves as further evidence of



the bias that existed on the part of Professor Blakey and the FPP toward me personally.

(581) At this time, I have not seen the final proposal prepared by Dr. Weston, but I know from the previous drafts that he was requesting photographs and data from members of the FPP that would corroborate various points that Dr. Weston felt should be emphasized in the FPPR. I cannot accept any such photographs and interpretations without having full details of those respective cases from the jurisdictions of the FPP members who have submitted such materials. In light of the bias and scientific inconsistency that these panel members have demonstrated in various facets of their overall involvement in this undertaking, I am not prepared blindly and naively to accept their representations of what a particular photograph is supposed to demonstrate and prove.

(582) There are numerous other items in the FPPR which are equally incorrect, inconsistent or susceptible to interpretations substantially different from the conclusions drawn by the FPPR. Regrettably, because of the August 11 deadline that has been imposed by Professor Blakey, I simply have not had sufficient time to mention and discuss each of these items in this Addendum report. In this regard, I wish to point out that I consider the time restriction imposed by Professor Blakey to have been extremely short and most unreasonable in light of the great amount of time that was given to Dr. Weston to prepare the FPPR.

(583) Also, I wish to point out for the record that I believe it was quite inappropriate and injudicious to have had the FPPR prepared by Dr. James Weston, in light of his previous involvement in a review of the WCR and his publicly acknowledged and officially recorded stance vis-a-vis the WCR. Once again, the fact that Professor Blakey and his staff either assigned, or permitted this assignment to be made to Dr. Weston is clear evidence of their blatant disregard for an objective, impartial approach to all the evidence in this case.

(584) Furthermore, at this time, I am not aware of the findings, interpretations and conclusions of other specialty panels that had been created by the HSCA to review the evidence in the JFK assassination. I do not understand how the FPP can prepare a final report without knowing what the final deliberations are of these other specialty panels. This is not the way forensic pathologists function, and I am truly amazed that they would have engaged in such an unprofessional approach in a matter of this magnitude.

CYRIL H. WECHT, M.D., J.D.,  
*Coroner of Allegheny County.*

Figures used in the dissenting view to the Forensic Pathology Panel Report, submitted by Cyril H. Wecht, M.D., J.D.

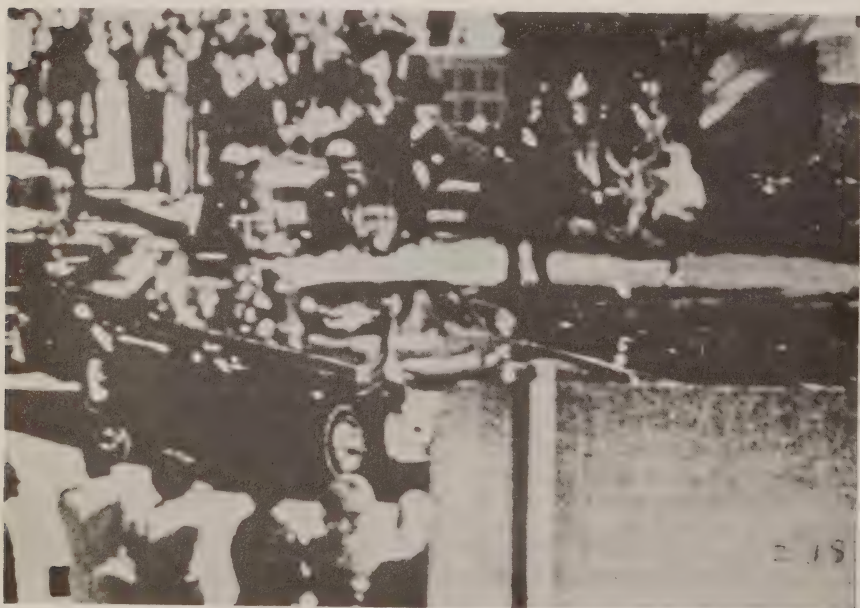
Wecht exhibits 1-6. Photographs demonstrating the physical relationship between President Kennedy and Governor Connally.

Wecht exhibits 7, 8, and 9. Photographs demonstrating the degree of deformity of bullet CE 399.

Wecht exhibit 10. Photograph displaying ammunition identical to CE 399, fired under the auspices of the Warren Commission in 1964.

Wecht exhibit 11. Photograph of a sketch illustrating the positions of the occupants in the presidential limousine.







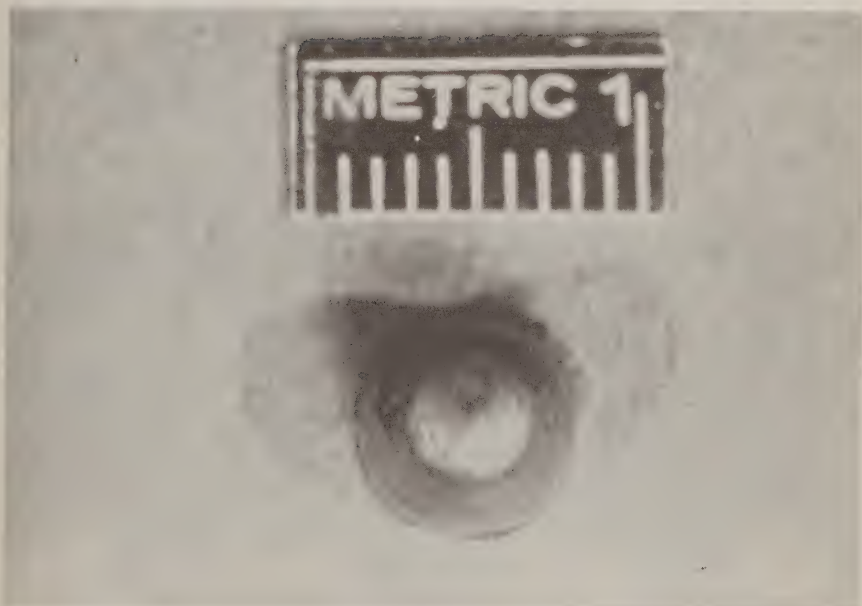
Clear of sign, Connally is unhurt, he say



Kennedy, emerging from behind sign, is wo













PART VII: MAJORITY RESPONSE TO THE DISSENT OF DR. CYRIL  
H. WECHT, M.D., J.D.

(585) The panel majority has considered all the issues raised by the panel minority of one. The conclusions of the panel majority remain unchanged in the absence of additional bona fide evidence.

## GLOSSARY

- Abrasion collar:** The dark circle around the margins of a bullet perforation of entrance, caused by the rubbing of a bullet against the skin as it stretches and penetrates it at the moment of impact.
- Acromion process:** The lateral end of the spine of the scapula (shoulder blade) which forms the top, outside, back portion of the shoulder.
- Anatomic position:** The position of the body at attention, with the face forward, the arms at the side, and the palms of the hand facing forward.
- Anterior-posterior:** Refers to X-rays taken with the beam proceeding from the front of the body (anterior) to the back (posterior), with the back part of the body against the X-ray plate (posterior-anterior view of the chest indicates that the chest is against the X-ray plate and the beam enters from the back).
- Apical or supraclavicular portion of the pleural cavity:** The uppermost part of the pleural cavity (lung cavity) adjacent to the neck and above the collarbone.
- Arachnoid:** A thin, transparent, delicate membrane that covers the brain.
- Axilla:** The armpit.
- Basilar aspect:** The underside of the brain.
- Beveling:** Beveling in bone resembles the beveling observed when a BB or small caliber missile strikes a plate glass window. (See fig. 16, depicting beveling.) Pathologists use this information to characterize the direction of travel of a missile through bony surfaces, since the margins of the defect on the bony surface where the bullet enters the bone are sharply outlined and may approximate the dimensions of the missile itself, while the margins where the bullet exits from the opposite bony surface are large, more irregular, and cratered. Missile fragments or bullets exiting from the skull produce a similar pattern in reverse direction, that is, the point where the bullet first strikes the skull on the inside of the exit point is smaller and the beveling extends to a larger, more irregular defect on the outer surface of the bone.
- Calvarium:** The top of the skull; the skullcap.
- Cecum:** The beginning of the large intestine or colon.
- Cerebellum:** The part of the brain immediately behind and below the cerebrum and situated in the lower back part of the skull.
- Cervical:** Refers to the area of the neck.
- Comminuted fracture:** A fracture in which the bone is broken into a number of fragments.
- Computer-assisted image enhancement:** \* A procedure in which graphic images are recorded on a television camera and then, with the assistance of an operator or by preprogramed instructions to the computer, color or light variations which are barely perceptible or are even imperceptible to the human eye are magnified so that they are more easily seen. The procedure assigns numbers indicating the level of intensity of the three primary colors in many tiny spots comprising the televised image. These numbers are stored systematically on the computer, thus "digitizing" the image. The programmer uses various mathematical manipulations of these numbers to render the enhancement.
- Contusion:** Bruise (results from trauma and bleeding from injured small blood vessels).

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\*Computer-assisted image enhancement of X-rays—a process somewhat different from that of photographic enhancement. In this technique, the initial steps of image digitalization are similar, but the mathematical programming serves to reduce the fuzzy, ill-defined shadows on the X-ray to rather concise lines, simulating line drawings prepared from X-rays.

**Coronal sectioning:** A technique for sectioning the brain, similar to slicing a loaf of bread. The brain is cut parallel to the coronal suture line of the skull, which extends from the front of one ear to the front of the other ear.

**Coronal suture:** See "suture lines."

**Corpus Callosum:** The part of the brain that connects the cerebral hemispheres.

**Cortex:** The outer part of an organ such as the brain or adrenal glands.

**Decerebrate rigidity:** Rigidity of the body or a part of the body which is caused by a muscle spasm of the entire body below the neck resulting from interference in the transmission of stimuli from the higher centers of the brain which maintain balance and muscle tone to the spinal cord.

**Definition:** In optics, the power of a lens to give a distinct image.

**Dermis:** The innermost layers of the skin.

**Dorsal aspect:** Refers to the posterior or back surface of the body or a part of the body as opposed to the ventral aspect, or anterior or front surface.

**Ecchymosis:** Hemorrhage or bleeding into tissues; often referred to as black and blue marks.

**Energy dispersive X-ray examination:** A technique which measures the radiation characteristic of different (chemical) elements when excited by an X-ray source. It allows one element to be distinguished from another, such as lead, copper, or zinc.

**Epidermis:** The thin, outermost layer of the skin.

**Epithelium:** A purely cellular layer covering the surface of the skin.

**Ethmoid:** Resembling a sieve.

**External occipital protuberance:** The prominence in the middle of the back of the skull.

**Falx cerebri:** A thin, fibrous membrane that extends between the cerebral hemispheres.

**Fascia:** A fibrous, connective tissue membrane.

**Forensic odontologist:** One who applies the technique of dentistry for medical-legal purposes to assist in identification of individuals by dental comparisons and examination of bite mark evidence.

**Frangible bullet:** A bullet composed of metal fragments designed to splinter on impact; often used in shooting galleries to prevent the ricocheting of bullets.

**Frankfort plane:** A standard reference point. It is a horizontal plane of the head which passes through the most inferior portion of the left orbit and the superior margin of the left external auditory foramen (ear canal).

**Fronto-parietal:** Refers to the front and upper aspects of the head and skull.

**Fronto-temporal:** Refers to the front and side aspects of the head and skull.

**Galea:** A thick, fibrous membrane between the scalp and the skull bones.

**Gross description:** Description of the body or body organs made with the naked eye and without the aid of a microscope.

**Gyri:** The rounded elevation of the outside of the cerebral hemisphere of the brain; the depressions are called sulci.

**Hemithorax:** One-half of the chest.

**Hemorrhage:** Bleeding.

**In-life:** Taken while the person was living.

**Interstitial emphysema:** Abnormal accumulation of air within tissues.

**Latissimus dorsi muscle:** The broadest muscle of the back.

**Lobe:** A rounded, projecting part.

**Mastoid process:** The lowest projection of temporal bone immediately behind the ear.

**Medial femoral condyle:** In the middle of the rounded articular surface at the extremity of the bone.

**Mediastinum:** The middle part or aspect of the chest.

**"Missile dust":** Refers to the X-ray appearance of tiny metal fragments deposited in the tissues along the course of a missile track.

**Necrosis:** The death of tissues.

**Obelion:** A point on the sagittal suture between the parietal foramina (small holes located approximately 0.5 to 1 centimeter lateral to the sagittal suture) approximately 5 centimeters above its posterior margin where it terminates in the lambdoidal suture, the semicircular suture extending around the occipital or back portion of the head and separating the parietal bones from the occipital bone.



*Occipital protuberance:* See external occipital protuberance.

*Occipital region:* The back part of the head.

*Occipital-parietal:* The upper, back part of the head and skull.

*Orbit:* The body socket which contains the eye.

*Paraffin blocks:* Wax blocks containing small pieces of tissue used in the preparation of slides for microscopic examination. It enables the cutting of the very thin sections necessary for microscopic study.

*Parietal:* Upper part of the skull or head.

*Periosteum:* Thin, fibrous membrane covering the bone.

*Photographic enhancement:* A process for improving the quality of an image for example, with a computer by converting picture elements into digital numbers that are systematically modified and converted back into picture elements.

*Pleural cavity:* The space in the chest containing the lungs.

*Pleural fluid:* Fluid present in the pleural cavity.

*Pneumothorax:* Air or gas in the pleural cavity.

*Positive pressure insufflation:* The Propulsion of air through a tube into the trachea and the lungs by a mechanical device during emergency treatment.

*Pulmonary contusion:* Contusion or bruising of the lung.

*Pulmonary parenchyma:* The substance of the lungs.

*Radiolucency:* Appearing as an empty space on an X-ray.

*Reverse jet effect:* The movement of an object in a direction opposite of the release of energy.

*Rifling:* Refers to the grooves in the barrel of a gun or rifle designed to impart rotation to a missile and make flight more accurate.

*Röntgenogram:* X-ray.

*Sagittal plane:* The plane through or parallel to the sagittal suture line of the skull which is at the top of the head between the parietal bone and extends from front to back in an anterior-posterior direction.

*Sagittal suture:* See suture.

*Scanning electron microscopy:* A technique in which a beam of focused electrons moves across an object. The secondary electrons produced by the object and the electrons scattered by the object are collected to form a three-dimensional image in a cathode-ray tube.

*Scapula:* Shoulder blades.

*Secondary missiles:* Objects which have become missiles as a consequence of being struck by the primary missile, which is usually a bullet. These missiles may include fragments of bone.

*Sella turcica:* Literally, "turkish saddle"; the depression in the sphenoid bone of the skull that contains the pituitary glands.

*Serratus anterior muscle:* A thin muscle between the ribs and scapula and the upper portion and sides of the chest.

*Soft-nosed bullet:* A bullet with a lead or unjacketed nose.

*Soft-nosed bullet:* A bullet with a lead or unjacketed nose.

*Soft X-ray examination:* A technique which employs X-rays at low levels to reveal materials not seen by normal X-ray techniques.

*Spectrographic analysis:* Technique in which a spectrograph is used to subject charged and accelerated ions to a magnetic field to detect differing molecular structures. This allows identification of various substances.

*Sphenoid sinus:* The air spaces in the sphenoid bone of the skull; they serve as accessory air spaces for the nose.

*Stephanion:* The junction of the coronal suture at its lateral extremity with the temporal line (the upper margin of the temporalis muscle insertion).

*Stereoscopic visualization:* Technique which involves the use of a stereoscope, an optical instrument with two eyeglasses, to assist the observer in combining the images of two pictures taken from points of view a small distance apart and thus to get the effect of solidity or depth.

*Subarachnoid:* Underneath the arachnoid membrane.

*Sulci:* See gyri.

*Supraclavicular:* The area above the collar bone (clavicular) at the root of the neck.

*Suprasternal notch:* The V-shaped indentation at the upper border of the sternum or breast bone at the base of the neck, in the midline.

*Suture lines:* The junctures in the skull between the various flat bones where growth occurs until the individual reaches maturity, when they close or fuse, thereby making the skull virtually one large bone. Even after closure, there are slightly indented residual lines, usually arranged in a somewhat zigzag pattern. Each of these suture lines has been named.

*Sylvian fissure:* The deepest and most prominent lateral cerebral fissure of the brain.

*Temporo-parietal:* Refers to the side and upper aspects of the head and skull.

*Thoracolumbar:* Refers to the chest and lower part of the vertebral column.

*Thorax:* Chest.

*Tragus:* The cartilaginous protusion in the front part of outer ear.

*Transparency:* An image (usually positive) intended to be observed by light that passes through the image and base, as on a viewer or by projection.

*Tumbling:* The rotation of a bullet over its longitudinal axis; sometimes resulting in the bullet "tumbling" end over end.

*Turcica:* See sella turcica.

*Vascular foramina:* Opening in bone through which blood vessels travel.

*Vastus medialis:* A prominent muscle in the front of the upper leg.

*Ventricles:* In reference to the brain, the normal cavities within the brain containing cerebro-spinal fluid.

*Vertex:* The crown or topmost part of the head.

*Visceral pleura:* A thin semitransparent membrane covering the outer surface of the lung and separated from the "parietal pleura" which lines the inside of the chest cavity, where the lung is suspended only by its attachment or hilum in the midportion of its medial surface.

*Volar:* Refers to the palm of the hand or the sole of the foot.

*X-ray back scatter:* A technique used to determine the presence of metal in tissue.

*Yaw:* The deviation of a bullet from its longitudinal axis during its line of flight, resulting from the spin imparted to the bullet by rifling and imperfection in the bullet due to construction or deformation in the bore or other imperfections in the gun, and also caused by resistance of air or tissues.

## ADDENDA TO THE REPORT OF THE FORENSIC PATHOLOGY PANEL

### ADDENDUM A

LIST OF THE DOCUMENTARY MATERIALS PROVIDED TO THE FORENSIC PATHOLOGY PANEL BY THE HOUSE SELECT COMMITTEE ON ASSASSINATIONS (PACKETS I AND II)

#### PACKET I

Autopsy protocol (Nov. 22, 1963).

Supplementary autopsy report (Dec. 6, 1963).

C.E. 397 (Humes' notes of Nov. 23, 1963 call to Dr. Perry and Humes' handwritten draft of autopsy report).

Autopsy descriptive sheet (Nov. 22, 1963).

W.C. autopsy diagrams (C.E. 385, 386, 400).

JFK documents: Death certificate (Nov. 22, 1963); authorization for post mortem examination (Nov. 22, 1963); and report of inquest (Dec. 6, 1963).

Secret Service reports on bullet trajectories: Dec. 12, 1963 by Elmer Moore; Feb. 14, 1964 by Roger C. Warner; and Jan. 28, 1964 by Roger C. Warner.

Connally medical records: admitting summary (Nov. 22, 1963); admitting note (Nov. 22, 1963); Parkland Hospital operative record (Nov. 22, 1963) (from C.E. 392); Secret Service report on Connally's wounds (Feb. 14, 1964, by Roger C. Warner); and body diagram (Commission No. 326) Nos. 1, 2, 3, 4, 5, 6.

Narrative summary—Anesthesia care for Governor John Connally (Nov. 25, 1963), Dr. Giesecke to C. J. Price).

Reports of diagnostic X-ray consultation by Dr. J. Reynolds—November 22, 24, 25, 26, 27 and 29, December 2 and 4, 1963; supplementary report (Nov. 29, 1963)

Surgical pathology report (Nov. 30, 1963—by Dr. Stembridge).

FBI reports regarding: metal fragment (Nov. 30, 1963—by J. Doyle Williams; Nov. 23, 1963).

Parkland operative record (Nov. 27, 1963—by Gregory).

Parkland operative record (Dec. 4, 1963—by Gregory).

#### JFK PARKLAND MEDICAL REPORTS—PACKET II

1966, index by Humes, Boswell, Ebersole, and Stringer; 1967, report by Humes, Boswell, and Finck; 1968, Clark panel report; 1975, Rockefeller panel reports; and receipts for photographs and X-rays.

FBI reports regarding: Harper skull fragment; FBI report (C.D. 205, pp. 153-4) regarding: examination of JFK clothing, and Hoover letter (to Rankin, Apr. 16, 1964) regarding: examination of Connally clothing.

Warren Report regarding: "The Autopsy" (W.R. 59-60) and regarding: "The Bullet Wounds" (W.R. 85-96).

FBI reports regarding: autopsy by O'Neill and Sibert—November 26 and 29, 1963.

#### *Articles by Cyril H. Wecht, M.D., J.D.*

"Appendix D: A Critique of President Kennedy: Autopsy," "Six Seconds In Dallas," by Josiah Thompson.

"The Medical Evidence in the Assassination of President Kennedy," "Forensic Science," 3 (1974): 105-128 (and Robert P. Smith).

"JFK Assassination: A Prolonged and Willful Cover-up," "Modern Medicine," October 28, 1974.

Interviews with Ken Rankin, "Physician's Management," October 1975 ("Part 1: The Evidence"); ("Part 2: The Cover-up"), November 1975.

"Pathologist: View of JFK Autopsy: An Unsolved Case," "Modern Medicine," November 27, 1972.

"A Post Mortem on the Warrenfeller Commission," "Juris," December, 1975.

#### *Articles by John K. Lattimer, M.D., F.A.C.S.*

"An Experimental Study of the Backward Movement of President Kennedy's Head," "Surgery, Gynecology, and Obstetrics," February, 1976 (and Jon Lattimer, Gary Lattimer).

"The Kennedy—Connally Single Bullet Theory—A Feasibility Study," "International Surgery," December, 1968 (and Jon Lattimer).

"Observations Based on Review of the Autopsy, Photographs, X-rays, and Related Materials of the late President John F. Kennedy," "Resident and Staff Physician," May 1972.

"Factors in the Death of President Kennedy," "Journal of the American Medical Association," October 24, 1966.

"The Kennedy—Connally One Bullet Theory: Further Circumstantial and Experimental Evidence," "Medical Times," November, 1974 (and Gary Lattimer and Jon Lattimer).

#### *Other documentary materials*

Warren Commission testimony of: Cdr. James J. Humes, Lt. Col. Pierre A. Finck, Cdr. J. Thornton Boswell, Dr. Malcolm O. Perry, Dr. George T. Shires, Dr. Charles F. Gregory, Dr. Martin G. White, Dr. Paul G. Peters, Dr. Adolph A. Giesecke, Jr., and Dr. William K. Clark.

Warren Commission testimony of: Dr. Don T. Curtis, Dr. Fuoad A. Bashour, Dr. Gene C. Akin, Dr. Charles J. Carrico, Dr. Charles R. Baxter, Dr. Robert Shaw, Rufus W. Youngblood, Clinton Hill, Roy H. Kellerman, and William Greer.

Warren report and volumes of hearings and exhibits.

Original autopsy documents (Archives: "Autopsy 4-1").

The original autopsy photographs and X-ray (including transparencies and negatives) were available, along with comparison X-rays of President Kennedy (X-rays taken from 1960-63), black and white enlargements of selected autopsy photographs, the original Connally X-rays, the original clothing, the bullet and bullet fragments, rifle, cartridges, limousine photographs, windshield, and slides from the Zapruder film. A film and slide presentation of the assassination was prepared and shown by Robert Groden.



## ADDENDUM B

LIST OF ADDITIONAL DOCUMENTARY MATERIALS PROVIDED TO THE FORENSIC PATHOLOGY  
PANEL BY THE HOUSE SELECT COMMITTEE ON ASSASSINATIONS

Black and white prints, color prints, and original transparencies:

1 <sup>1</sup> (18 JB <sup>2</sup> )	16 (10 JB)	38
2 (17 JB)	17 (2 JB)	39
3 (14 JB)	18 (JB)	40
4 (13 JB)	26	41
5 (9 JB)	27	42
6 (3 JB)	28	43
7 (16 JB)	29	44
8 (7 JB)	30	45
9 (11 JB)	31	46
10 (12 JB)	32	47
11 (6 JB)	33	48
12 (5 JB)	34	49
13 (8 JB)	35	50
14 (15 JB)	36	51
15 (4 JB)	37	52

<sup>1</sup> National Archive Numbers.

<sup>2</sup> Dr. J. Thornton Boswell.

Pictures of Harper Bone Fragment.

Film and slide presentations by Robert Groden. Photographs of the presidential limousine.

X-rays:

1	6	11
2	7	12
3	8	13
4	9	14
5	10	

Comparison X-rays of John F. Kennedy (taken 1960-63).

Bullets and fragments: CE 399, CE 567, CE 569, and CE 840.

Motion picture films: CE 904—Zapruder film and CE 905—Nix film.

Single frame pictures of Zapruder film, frames 215 through 334.

Clothing of John F. Kennedy: CE 393 suit coat; CE 394 shirt; and CE 395 necktie.

Clothing of Governor Connally: Suit coat, shirt, and trousers.

Other: Oswald rifle, clips, spent shells and windscreen and windshield from the Presidential limousine.

## ADDENDUM C

**REPORT OF G. M. McDonnel, M.D., CONCERNING THE OBSERVATIONS, ANALYSIS, AND CONCLUSIONS IN CONNECTION WITH THE RADIOGRAPHIC IMAGES AND ENHANCED IMAGES OF X-RAYS ATTRIBUTED TO PRESIDENT JOHN F. KENNEDY, DATED AUGUST 4, 1978**

**DEPARTMENT OF RADIOLOGY  
THE HOSPITAL OF THE GOOD SAMARITAN**

616 SOUTH WITMER STREET  
LOS ANGELES, CALIFORNIA 90017

*Diagnostic Radiology*

ROBERT E. LEVIS, M.D.  
GERALD M. McDONNEL, M.D.  
JOSEPH L. WESTOVER, M.D.  
PHILLIP C. SHIU, M.D.  
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RICHARD M. GARVER, M.S.  
MELISSA C. MARTIN, M.S.

*Nuclear Medicine*

LEONARD A. SWANSON, M.D.  
TELEPHONE 488-8245

TO: Michael Goldsmith  
Senior Staff Counsel  
Select Committee on Assassinations  
U.S. House of Representatives  
3342 House Office Building, Annex 2  
Washington, D.C. 20515

DATE: August 4, 1978

SUBJECT: Report of G.M. McDonnel, M.D. concerning observation, analysis, and conclusions in connection with radiographic images and enhanced images attributed to President John F. Kennedy.

This report replaces my report of March 8, 1978 and supplements my presentation of July 21, 1978 in the Rayburn Building, Washington, D.C.

I was exposed to radiographic images identified by the number 21296 at Aerospace Corporation, El Segundo, California on March 7, 1978. At my suggestion portions of these radiographs were digitized and enhanced by Aerospace Corporation for further observation and analysis.

I participated in discussions during the photographic evidence panel on 6 and 7 April 1978 during which time I dialogued with Dr. James Weston concerning my interpretation of these radiographs and the enhanced images.

On 2 June 1978 I again viewed and analyzed the radiographic images at the National Archives Building in Washington, D.C. As requested I also interpreted and analyzed skull and sinus radiographs obtained during the lifetime of the subject for the specific purpose of authenticating the radiographs obtained before and after the autopsy.

The original radiographs seen on 7 March were:

- a. An attempted anteroposterior projection of a skull identified as:  
21296 (numbers upside down)  
US Naval Hospital  
NNMC Bethesda Maryland  
11 22 63
- b. Right lateral projection of a skull with the same identification symbols.
- c. Left lateral projection of a skull with the same identification symbols.

- d. Three radiographs of three fragments of bone unidentified by symbols.
- e. An anteroposterior projection of a chest with the same identification symbols as a, b, c above. This radiograph was obtained with the thoracic cage intact, i.e., before autopsy.
- f. An anteroposterior projection of a chest with the same identification as e above. This radiograph was obtained after the thorax had been opened and the lungs and mediastinal contents had been removed.

The findings and interpretation of the skull films are:

1. Nearly complete loss of right parietal bone, the upper portion of the right temporal bone, and a portion of the posterior aspect of the right frontal bone.
2. Subdural air over the left parietal hemisphere.
3. Multiple skull fractures and disruption of continuity of the bony tables.
4. A metallic fragment on the outer table of the right occipital bone 9.6 cm. above the mid portion of the external occipital protuberance (EOP). 1 cm. above the metallic fragment is a depressed fracture from which stellate type fractures "radiate" into both occipital bones, the right parietal bone and the right temporal bone. These are vividly and convincingly displayed in the enhanced images, specifically the "anteroposterior" (AP) projection of the skull. The metallic fragment in this projection is nearly spherical in contour.
5. There is a fracture line extending through the floor of the sella turcica with bony fragments in the sphenoid sinus. This is vividly depicted in the enhanced images.
6. There are fracture lines through the anterior and posterior aspects of the right frontal sinus with air in this sinus. There is a metallic fragment above the sinus appearing to be between the bony tables of the frontal bone.
7. There is elevation of the galea medial and lateral, as well as anteriorly, to the depressed fracture in the right occipital bone. A small metallic fragment lies medial to the fracture site between the galea and the outer table of the skull.

The mechanism of damage to the skull is concluded to be:

1. A low mass, high velocity, metallic projectile penetrated the right occipital bone at the area of the depressed fracture, leaving behind the spherical shaped contoured metallic fragment in 4 above.
2. The reflected shock wave from the outer table propelled a metallic fragment medially as in 7 above.
3. The stellate type "radiating" fractures as in 4 above resulted from the entering metallic projectile.
4. (also 8 in findings).



A linear alignment of tiny metallic fragments is associated with the entry, path of travel, and exit in the posterior aspect of the right frontal bone.

#### CHEST

The pre-autopsy radiograph of the chest shows air in the soft tissues of the right supraclavicular area soft tissues.

There is an undisplaced fracture of the proximal portion of the right transverse process of T1 (or the region of the costovertebral junction).

There is no evidence of fracture of the cervical spine or its associated appendages.

In the post autopsy film of the thoracic region there is debris in the radiographic image superimposed over the area to the right of the C7 vertebral body.

In the enhanced post autopsy image of the same area, there appears to be fractures of the posterior aspects of the 2nd, 3rd, and 4th ribs. These are artifacts.

#### Authentication of Radiographs.

The following radiographs were provided at the National Archives, Washington, D.C. on June 2, 1978.

- a. A left lateral skull radiograph dated 8/17/60 performed by Groover, Christie and Merritt, with number 336042 and blue ink writing of "Kennedy".
- b. A paranasal sinus series performed by (or for) Stephen White, M.D., 521 Park Ave. NYC, dated 8/14/60, and identified by number 202617.

The following anatomical and bony structures are common and identical to all three sets of radiographs.

1. The thickness and contour of the frontal bones.
2. Deviation of the mid portion of the nasal septum from right to left.
3. The contour of the frontal sinuses.
4. The contour and shape of the sella turcica.
5. The contour of the posterior clinoids.
6. The contour and calcification of the posterior clinoid ligaments.
7. There is thickening of the medial and superior aspects of the mucoperiosteal margin of the left frontal sinus. This is less severe in the radiographs of 8/14/60 and 8/17/60 than in the radiographs of 11/22/63. The general margin of this tissue swelling is similar in all three studies.

In my opinion the three sets of radiographs are positively and without controversy, of the same individual. It is impossible to simulate the referenced anatomical landmarks, the nasal septum deviation, and the documentation of the progressive disease process in the left frontal sinus.

### Enhancement of the Radiographic Images.

The digitized and enhanced images produced by Aerospace Corporation permitted definitive observation and analysis of the original radiographs. Further, enhancement permitted analysis or elimination of artifacts on the images. The most vivid result is the clear definition of the multiple fractures radiating from the area of the entrance of the penetrating missile in the right occipital bone.

### "Doctoring" of the Radiographic Images"

In my opinion the images which I have seen have not been "doctored" or "treated" in any fashion, except for:

- a. Two small areas of thermal damage resulting from a light source held too close to the "anteroposterior" image. These were reported to be present on an observation report dated November 1, 1966 and validated by signature November 10, 1966. This report is in the National Archives. Interestingly, the enhanced images downgrade the prominence of the "burns" while enhancing the true radiographic image.
- b. Minor "staining" or discoloration of the images due to incomplete processing of the film in the developing process. This discoloration has, and will continue to be, more prominent with the passage of time.

The linear opacities associated with the images have been said to be the result of manipulation. These opacities or normal grid lines from the grid used to eliminate "scatter fogging" of the images at the time of exposure of the films and therefore represent normal images without evidence of manipulation.

### Final Summary:

1. The observations of the findings are as stated and validated by the enhanced images.
2. The described mechanisms of damage are the writer's professional opinion.
3. The radiographs observed are incontrovertibly of the same individual during life and the early post mortem period.
4. The observed radiographic images have not been altered in an effort to provide a false image.

  
G.M. McDonnell, M.D.

GMM:st

8 March 1978

ENCLOSURE NO. 1

Statement by Dr. G. M. McDonnell

On 7 March 1978, at The Aerospace Corporation, I was asked to interpret six radiographs which are identified by the Number 21296, dated 11/22/63, and Bethesda NMC. The views were

- a. an attempted anterior-posterior projection of a skull
- b. two lateral projections of a skull--one marked "L", the other marked "R"
- c. three radiographs of three fragments of skull

These radiographs were unenhanced. My preliminary interpretation follows:

1. A nearly complete loss of structure of the right frontal and parietal bone.
2. A metallic fragment on the outer table of the right occipital bone approximately 10 cm above the external occipital protuberance. In the same area is a depressed fracture. In the anterior-posterior projection, there appears to be fracture lines to the occipital, parietal, and temporal bone, radiating from the area of the fracture and metallic fragments. The metallic fragment is nearly spherical in this projection.
3. There is elevation of the galea medial and lateral to the area of the fracture and metallic fragment in the occipital region. A small metallic fragment is located medial to the location of the spherical metallic fragment and fracture lying between the galea and the outer cranial table.
4. There is a fracture line through the floor of the sella turcica with bony fragments in the sphenoid sinus.
5. There are fracture lines through the anterior and posterior aspects of the anterior ethmoid cells with air in the right side anterior ethmoid.

**My preliminary chronological conclusions are:**

1. A low mass, high velocity projectile entered the right occipital region.
2. A shock wave is reflected off the outer table of the occipital bone in the region of entry with elevation of the galea and medial movement of the metallic fragment as in Paragraph 3 above.
3. Fractures into the sphenoid sinus and the anterior ethmoid area.
4. There is tremendous intracranial pressure resulting in disruption of the cranial tables as in Paragraph 1 above with loss of brain substance and the projectile.

It is respectfully requested that this interpretation may be modified after analysis and study of enhanced images of the referenced radiographs.



## ADDENDUM D

REPORT OF DAVID O. DAVIS, M.D., CONCERNING THE EXAMINATION OF THE AUTOPSY  
X-RAYS OF PRESIDENT JOHN F. KENNEDY, DATED AUGUST 23, 1978

REPORT OF DAVID O. DAVIS, M.D., CONCERNING THE EXAMINATION OF THE AUTOPSY  
X-RAYS OF PRESIDENT JOHN F. KENNEDY, DATED DECEMBER 22, 1978



THE  
GEORGE  
WASHINGTON  
UNIVERSITY  
MEDICAL CENTER

Department of Radiology  
Diagnostic Division  
(202) 676-4600

The University Hospital / 901 Twenty-Third Street, N.W. / Washington, D.C. 20037

MEMORANDUM TO: Mr Mark Flanagan, US House of  
Representatives Select Committee on  
Assassinations  
Staff Member

FROM: David O Davis, MD  
Professor and Chairman  
Department of Radiology  
The George Washington University Hospital  
Washington DC

PLACE: The George Washington University Hospital  
Department of Radiology  
Washington DC

DATE: August 23, 1978

SUBJECT: Examination of JFK Autopsy X-Rays

PERSONS PRESENT: Doctor Davis, Mr Mark Flanagan (HSCA), Mr Michael  
Leahy (National Archives)

I reviewed the Kennedy skull films labeled #1 and #2, taken at the US Naval Hospital on September 22, 1963, and two aerospace enhanced images of those films.

The findings are as follows:

There is massive calvarial damage, which will be described below. There is a metallic fragment about 9 or 10cm above the external occipital protuberance. which metallic fragment is apparently imbedded in the outer table of the skull. On the frontal view, this metallic fragment is located 2.5cm to the right of midline, and on the lateral view, it is approximately 3-4cm above the lambda. There are a large number of fractures in the calvarium, and the linear fractures seem to more or less emanate from the imbedded metallic fragment, and radiate in a stellate fashion in various directions. There is a large fracture extending directly anteriorly along the sagittal suture, which is, at least at the point visualized, widely separated. This fracture seems to extend into the frontal bone, more or less at the midline, down to

the frontal sinus which is also fractured. There is a sharply defined linear fracture extending laterally from the metallic fragment into the left side of the calvarium, around the parietal bone to the lateral aspect of the skull. Two linear fractures extend inferolaterally from the metallic fragment, one into the occipital bone, about 3cm from the midline, and this fracture crosses the lambdoid suture. The other one is more lateral, and extends down toward the lateral sinus, probably above the lambdoid suture.

Additionally, there is a fracture line extending more or less laterally from the metallic fragment toward the temporal bone on the right side, which is identified only by the anterior edge of the posterior fragment, since there is apparently absence of bone anterior to this line, with the absence present to a point approximately equivalent to where the coronal suture on the right side should be.

There is a fracture fragment inferior to the absent bone, with the corner of the fragment extending down to the parietal squamosal suture, and this fragment is displaced from its normal position as indicated by overlap of the infero and posterior aspects of the fracture fragment. There is a faint line extending inferiorly from the superior aspect or vertex of the skull towards this fragment, which I feel is probably a shadow caused by avulsed scalp and is not explained by absent bone although it projects essentially over the central portion of the absent parietal calvarium that is evident.

The absent bone in the parietal region apparently includes some fragment from the left parietal region, since the fracture seems to cross the midline where there is some lucency, and presumably part of the sagittal suture and sagittal sinus is absent.

The right orbital rim is also fractured laterally, and the roof of the orbit is fractured on the right side, as is the inferior orbital rim, indicating that there is an unstable orbit.

There are a number of metallic fragments extending anteriorly from the inner table of the skull at a point approximately 6cm antero-superiorly from the previously described imbedded metallic fragment. These fragments extend inferoanteriorly across the entire skull and actually project (on other images that I have seen) in a fashion that suggests that the large fragment is outside the intracranial space. Presumably this represents a metallic fragment in the scalp, although this cannot be accurately determined from this particular examination.

There is some air in the subarachnoid space of the spinal canal, and also apparently in the temporal lobe sulci in the middle fossa, presumably on the right side, but since the fracture is open to the subarachnoid space, this is not at all surprising.

CONCLUSION: There is an extensive comminuted, open, explosive calvarial fracture which seems to radiate in various directions as described above from a central point which is located in the right parietal bone, 3cm from the midline and about 9 or 10cm from the external occipital protuberance. There is absence of a part of the calvarium, beginning near the impact point and extending anteriorly to the coronal suture, with absence of a significant amount of bone in the right parietal and presumably a small amount of left parietal region. There is a displaced fragment or fragments in the right frontal and parietotemporal region, with some overlap of the bone. There is a significant fracture in the frontal region extended into the right orbit and frontal sinus. The fractures also extend, from the posterior impact point, into the occipital bone on both sides.

I neglected to describe in the text of this report an extensive fracture which extends inferolaterally from the impact point toward the left side which probably reaches the temporal bone or at least the mastoid region after crossing a goodly portion of the occipital bone there. It seems apparent that explosive impact occurred in this calvarium. It also seems reasonable to assume that the exit point is near the coronal suture on the right side, about 5 or 6, or perhaps slightly more, cm above the pterion. It is not possible to totally explain the metallic fragment pattern that is present from some of the metallic fragments located superiorly in the region of the parietal bone, or at least projecting on the parietal bone, are actually in the scalp. The frontal view does not give much help in this regard and it is impossible to work this out completely.

I have also reviewed the films numbered 8, 9 and 10, which are of the thoracic region. In addition, I reviewed a film taken at Doctor White's office on Park Avenue in New York, in 1960.

Evaluation of the pre-autopsy film shows that there is some subcutaneous or interstitial air overlying the right C7 and T1 transverse processes. There is disruption of the integrity of the transverse process of T1, which, in comparison with its mate on the opposite side and also with the previously taken film, mentioned above, indicates that there has been a fracture in that area. There



is some soft tissue density overlying the apex of the right lung which may be hematoma in that region or other soft tissue swelling.

Evaluation of the post-autopsy film shows that there is subcutaneous or interstitial air overlying C7 and T1. The same disruption of T1 right transverse process is still present.

On the film of the right side, taken post-autopsy, there are two small metallic densities in the region of the C7 right transverse process. These densities are felt to be artifact, partly because of their marked density, because there is a similar artifact overlying the body of C7, and because these metallic-like densities were not present on the previous, pre-autopsy film. Therefore, I assume that these are screen artifacts from debris present in the cassette at the time that this film was exposed.

OPINION: There is evidence of interstitial air on the pre-autopsy film, and evidence of a right T1 transverse process fracture, both on the pre-autopsy and post-autopsy film. The fracture fragments are not significantly displaced. I do not feel that there is any evidence of foreign body on these films, and that the small metallic density mentioned above, overlying the C7 transverse process region, is actually an artifact.

DOD/mhw



THE  
GEORGE  
WASHINGTON  
UNIVERSITY  
MEDICAL CENTER

*The University Hospital / 901 Twenty-Third Street, N.W. / Washington, D.C. 20037*

*Office of the Chairman  
Department of Radiology  
(202) 676-4650*

December 22, 1978

Mr Kenneth Klein  
US House of Representatives  
Select Committee on Assassinations  
House Annex #2  
Washington DC 20015

Dear Mr Klein:

In light of the recent revelations concerning the alledged acoustical evidence of a fourth shot in the Kennedy assassination in 1963, Doctor Michael Baden and I reviewed the appropriate x-ray films and photos.

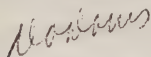
After careful perusal of all of the material, I must say that I see no evidence to support any belief that a second shot struck President Kennedy's skull. It seems that the drawings that were produced, after our previous work, are correct. In fact, we were even more convinced after this perusal that the bullet that entered President Kennedy's head in the right posterior aspect actually exited in the right frontal region, at the midportion of the coronal suture, just as is shown on the drawings. There are no additional fragments that cannot be explained by this posteriorly entering missile, and some x-ray and photographic evidence of metallic deposition and beveling seems to strongly confirm the fact that the right frontolateral injury is secondary to an exit wound at that location.

Careful consideration was given to the fact that the fourth shot may have come from the "grassy knoll" and visualization of the course that such a bullet would have to take tends to completely rule out any additional missile striking President Kennedy from the right side. We then considered all of the possibilities and came to the conclusion that the only possible occurrence would have required President Kennedy's head to have been tilted to the left side, that is, with the right ear elevated and the left depressed, to a level

of about  $22^{\circ}$  off horizontal, if the bullet were to travel a horizontal path on a level with President Kennedy's upper skull. Any additional degrees of angulation required by an assessment of the height of the grassy knoll in relation to Mr Kennedy's head would have to be added to the above mentioned  $22^{\circ}$ , in order to justify our potential explanation that a tangential blow might have been struck to the right top of Mr Kennedy's skull at about the same time the posterior missile entered. In other words, if the grassy knoll would require a downward pathway of  $15^{\circ}$  off the horizontal, the head would have to be tilted approximately  $37^{\circ}$  to the left at the time of impact. If the films of Mr Kennedy's head at the time of impact do not show such a tilt, I think that it is completely reasonable to assume that there was no possible head wound from the right side. As mentioned above, all of the other analysis totally supports this conclusion, that is, that there was no second bullet wound in Mr Kennedy's skull. I hope that this is a clear statement and that these impressions and opinions will be useful to you in the upcoming considerations.

Thank you very much for the opportunity to participate.

Sincerely,



David O Davis, MD  
Professor and Chairman  
Department of Radiology

DOD/mhw



## ADDENDUM E

MEMORANDUM OF J. LAWRENCE ANGEL, ADDRESSED TO "JFK SKULL REVIEW COMMITTEE" OF THE FORENSIC PATHOLOGY PANEL, DATED OCTOBER 24, 1977

OPTIONAL FORM NO. 10  
5010-104

UNITED STATES GOVERNMENT

002838

# Memorandum

TO : JFK skull review committee

DATE: October 24, 1977

FROM : J. Lawrence Angel

SUBJECT: Study of pictures and X-rays of bone fragments related to those of JFK

The writer of this report is Curator of Physical Anthropology at the Smithsonian Institution ( since 1962 ) and Professorial Lecturer in Anatomy and Anthropology Departments of the George Washington University and in Forensic Sciences Department of the Johns Hopkins School of Public Health (in connection with a seminar in Forensic Anthropology). He received his A.B. from Harvard in 1936 and his Ph.D. from Harvard University in 1942. He taught at the universities of California and Minnesota and from 1943-1962 taught in the Anatomy department at the Jefferson Medical College, Philadelphia, leaving as Professor of Anatomy and Physical Anthropology. For some years before leaving he served as consultant in Surgical Anatomy at the U.S. Naval Hospital in Philadelphia, specializing in the head and neck. He has studied hundreds of skeletons for law enforcement agencies in the past 15 years and thousands of archeological skeletons.

In order to approximate the position of 2 major loose fragments it is necessary to define the gap seen in X-rays (especially # 1 and 2) and photographs (especially #44 transparency and photograph) of the head and skull of JFK now kept at the National Archives. This gap where bone is missing along the top and right side of the skull vault extends from just behind obelion (area of the parietal foramina) forward almost to the frontal bosses anteriorly. From the radiopaque lump behind obelion which with cracks appears to mark the bullet entry the left margin of the gap goes forward just to the right of the sagittal suture to a region of major fracture just behind vertex where the margin moves about 1 cm to the left of the midline. From here the margin extends diagonally forward to the left to a curved area about 5 cm above the left orbit and about 5 cm from the midline. The anterior

edge of the gap crosses to the right, stepping down about the midline to a level 5 cm above nasion and then sloping down to an area where there is an almost semicircular lacuna about 35 mm above the middle of the right orbit. To the right of this a vertical crack extends down to the orbit (an area of discoloration, apparently subcutaneous, appears of the lateral photograph of JFK around the frontomalar angle of the right orbit). From a level about 4 cm above the frontomalar angle the bone margin extends backward on the right side, with another V-shaped crack in front of the coronal suture. Behind this point the whole antero-inferior quarter of the right parietal lies loose. Its upper border was about 5 cm above the squamous suture but in X-ray #2 it appears shifted downward about 1 cm. From the point where it met the posterior half of the right parietal a big crack extends back and down, and the posterior boundary of the gap goes backward and upward to the starting point just to the right of obelion.

X-rays 4, 5, and 6 show a large piece of skull vault, clearly frontal bone with an apparent jagged line indicating coronal suture, about 7 to 8 cm long. The apparent inferior (right) border is 6 cm long and at the irregular <sup>right</sup> angle which it makes with the jagged (coronal) border are several radiopaque marks (part of bullet?). The third (anterior) edge of the fragment is curving. This large fragment appears to be the upper part of the frontal bone, extending more on the right than on the left, and leaving spaces both in front and to the right. The two smaller fragments in X-rays 4, 5, and 6 are insufficient to fill these gaps.

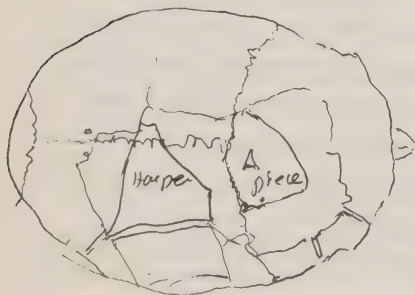
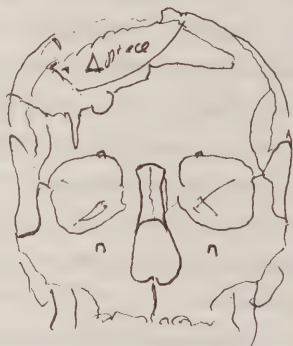
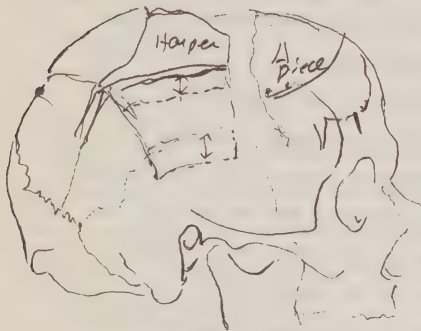
The Harper fragment photographs show it as a roughly trapezoidal piece, 7 x 5.5 cm in size, coming mainly from the upper middle third of the right parietal bone. Near its short upper edge vascular foramina on the inside and a faint irregular line on the outside indicate sagittal suture. Its postero-inferior pointed angle appears to fit the crack in the posterior section of the right parietal and its slightly wavy lower border can fit the upper edge of the loose lower section of right parietal. Its upper short border, on the left of the midline near vertex, may meet the left margin of the gap. Behind it there appears to be a large gap and in front a narrow one.

The entrance of the bullet appears to have been just below obelion and 18 mm to the right of the midline (X-rays 1 and 2). From here radiopaque fragments appear along an expanding track almost parallel to Frankfort and sagittal planes. The exit area through the right frontal above the boss can account for the small semicircular notch 35 mm above the right orbit, the radiopaque mark near this, and at the upper right part of the track can explain the radiopaque markings on the triangular frontal fragment just in front of the coronal suture above stephanion.

The two big loose fragments of skull vault, from upper frontal and parietal areas, more on the right than the left side, do not articulate with each other and leave three appreciable gaps unfilled.

To Lawrence Angel

--- = position in X-ray



← Top view sketch is detached, not observed



## ADDENDUM F

REPORT ON THE SOFT X-RAY AND ENERGY DISPERSIVE X-RAY ANALYSIS OF THE CLOTHING OF JOHN F. KENNEDY AND JOHN B. CONNALLY PREPARED BY SOUTHWESTERN INSTITUTE OF FORENSIC SCIENCES, DALLAS, TEX., DATED FEBRUARY 1, 1978



**SOUTHWESTERN  
INSTITUTE OF FORENSIC SCIENCES  
AT DALLAS**

5230 Medical Center Drive  
Dallas, Texas 75235

TELEPHONE 638-1131  
AREA CODE 214

REPLY TO:  
P.O. BOX 35728

Office of the Director

February 2, 1978

005090

Mr. Donald A. Purdy, Jr.  
Staff Counsel  
Select Committee on Assassinations  
U.S. House of Representatives  
3331 House Office Building, Annex 2  
Washington, D.C. 20515

Dear Mr. Purdy:

Enclosed are the following:

1. The report concerning the examination of J.F.K. and J.B.C. clothing.
2. The soft x-ray films
3. The polaroid photographs of the oscilloscope display.

I trust that you will distribute the report to the several members of the Committee. I have discussed it with Doctor Davis already and also am sending a letter regarding it to Doctor Loguvm.

I must stress that there are no duplicates of the polaroid photographs or the x-ray films.

As I recall it it was the understanding that Dallas County would be reimbursed for the film used. How do you want me to make the bill read and to whom should it be addressed? Also, I am anxious to reimburse one of the members of the Institute for the extensive time he put into the analysis of the clothing. As I recall it, I was to bill you for one or two days of my consultation time. Then I can reimburse him for that. Is this satisfactory with you?

Before you set the meeting date in March I would hope that you might contact each of the medical consultants individually. I believe Doctor Davis has something planned for the first or second weekend in March.

Sincerely yours,

*Charles S. Petty*  
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Soft X-ray & Energy Dispersive X-ray Analyses of Clothing

J.F.K. and J.B.C.

11/10/77 and 11/15/77

Southwestern Institute of Forensic Sciences at Dallas

Charles S. Petty, M.D.  
Director

Report of 2/1/78

This report details the analyses performed on the clothing of J.F.K and J.B.C. As described in other reports of the Committee of Medical Consultants, the clothing of both J.F.K. and J.B.C. were visually examined at the National Archives on 16 September 1977. Following this preliminary examination, the decision was made to bring the clothing to the Southwestern Institute of Forensic Sciences at Dallas, there to subject the clothing to examination by two different scientific techniques:

1. Soft x-ray (SX)
2. Energy dispersive x-ray (EDX)

Accordingly, the clothing of J.F.K. and J.B.C. were brought to Dallas and the analyses were conducted on two different days, 10 November 1977, and 15 November 1977. The analyses would have been completed on the first day, but one aberrant result obtained during the analysis of the J.B.C. clothing caused me to want to repeat the analysis by EDX. This was done on 15 November 1977, thus the two analysis dates are explained.

#### Explanation of analytical techniques:

1. Soft x-ray (SX)

This technique employs x-radiation at low energy (10 kilovolts and 2 milliamps). With such low energy, particulate and other material can easily stop x-ray penetration and thus be made visible on the x-ray film. As an example, very tiny metallic fragments, powder particles, and even the weave of textiles can be visualized. This technique cannot be achieved when using ordinary (clinical) x-ray equipment because the energy output of such equipment is much too high.



## 2. Energy dispersive x-ray (EDX)

This technique measures the radiation characteristic of different (chemical) elements when excited by an x-ray source. Thus one element can be distinguished from another, or sorted out from a group of elements. Elements such as lead, copper, zinc, etc. are metallic and heavy and are easily detected and identified by this technique.

## 3. These two different techniques were chosen because:

- a. Both are non-destructive, that is, the garments analyzed are not altered, or destroyed.

- b. Soft x-ray can be readily employed to locate particles of interest (if any) which may then be analyzed using energy dispersive x-ray. In other words, the first technique is used to scan the area of interest and the second can then be employed to focus upon minute areas.

## Format of results:

### 1. Soft x-ray (SX)

Actual x-ray films are attached to this report and should be referred to so as to make the explanation more understandable.

- a. Film #1, J. F.K..

Two different garment views are shown. Both are of the shirt. One view is of the defect area in the back of the shirt, the other shows the two defects in the front of the shirt. The weave of the fabric is easily discerned. The defects show clearly. Clearly shown, also, is the area from which fabric was removed from the back

defect for spectrographic analysis (F.B.I. Laboratory).

b. Film #2, J.F.K.

Two different garments are shown: the back of the coat, and the four-in-hand necktie. In the former the defect shows up well; in the latter, the rub or graze shows less well but can be discerned.

c. Film #1, J.B.C.

Two views of the shirt, showing well both the back and front defects.

d. Film #2, J.B.C.

Two garments are shown: the French cuff area of the shirt, and the thigh area of the trousers. The defects are easy to see.

e. Film #3, J.B.C.

There is one view of the shirt with the back defect well shown.

f. Film #4, J.B.C.

Two views of the coat are included: one shows the defect in the front, the other showing the right coat sleeve.

g. Film #5, J.B.C.

Two views of the coat are included: one shows the right front defect, the other the right back defect.

## 2. Energy dispersive x-ray (EDX)

Two different formats are included: a numerical report which represents the number of counts per 100 seconds for the element which is being analyzed. Thus, the higher the count, the more

of that particular element is present. The other type of report is in the form of polaroid photographs of the oscillograph recording of the 100-second count result for a given element.

a. J.F.K. clothing: nine polaroid photographs are attached.

b. J.B.C. clothing: fourteen polaroid photographs taken 11/10/77, and five polaroid photographs taken 11/15/77 are attached.

All of the polaroid photographs are attached only to illustrate the type of oscillograph representation found, and not to replace the numerical results reported below which are complete. The polaroid photographs alone cannot be used from which to calculate the numerical results.

The numerical results of the EDX analyses are as follows:

a. J.F.K. - analysis date: 11/10/77

<u>Garment</u>	<u>Area</u>	<u>Copper</u>	<u>Lead</u>	<u>Iron</u>	<u>Chromium</u>	<u>Bromine</u>	<u>Zinc</u>
Coat	Defect	874*	478	3302**	7410		
	Control	346	245	431	6561		
Shirt	Back defect	148	201	N.A.	N.A.		
	Collar	255	81	N.A.	N.A.	293	
	Tail	136	35	N.A.	N.A.		
	Rt.front defect	494 <sup>†</sup>	307	N.A.	N.A.		
	Lt.front defect	166	139	N.A.	N.A.		
Tie	Graze	231	70				3872
	Control	240	104				3746

Notes:

\* This is a borderline count, indicative of only a trace of copper.

\*\* Area stained by blood. This accounts for iron present.

<sup>†</sup>This is a borderline count, indicative of only a trace of copper.



## b. J.B.C. - analysis date 11/10/77

<u>Garment</u>	<u>Area</u>	<u>Copper</u>	<u>Lead</u>	<u>Iron</u>	<u>Chromium</u>
Coat	Rt.sleeve control	142	143	212	3498
	Rt.sleeve defect	184	125	239	3470
	Rt.back control	327	127	305	8603
	Rt.back defect	437	190	620	8895
	Rt.front control	9281*	106	103	N.A.
	Rt.front defect	4529**	208	4833 <sup>†</sup>	N.A.
Shirt	Front control	198	11	153	
	Front defect	324	136	610	
	Back control	193	0	162	
	Back defect	185	58	371	
	Cuff control	128	5	160	
	Cuff defect	157	107	196	
Trousers	Control	230	113	5421	
	Defect	270	90	5557	

## c. J.B.C. - analysis date 11/15/77

Coat	Rt.front defect		
	Several layers	3005 <sup>††</sup>	0
	One layer	4532 <sup>††</sup>	0
	Above Rt.front defect	550	0
	Below Rt.front defect	411	0
	Without lining	420	0
	With lining	64 <sup>§</sup>	0

## Notes:

\* This is aberrant count as proven by repeat analyses five days later.

\*\* Indicative of copper present in quantity.

<sup>†</sup> Blood stains still detectable accounting for iron present.

<sup>††</sup> Indicative of copper. Confirms \*\*.

<sup>§</sup> Negative. Confirms suspicions of aberrant count as noted in \* above.

### Discussion:

The two types of non-destructive analyses were undertaken to:

1. Determine if any particles of missiles still remained on the clothing.

2. To analyze the missile fragments, if any, and to define the elemental nature of them.

3. To see if any correlation might be made between the elements found and missile behavior after striking J.F.K. and J.B.C.

In regard to J.F.K. clothing:

At the periphery of the defect in the back of the shirt some very tiny particles of foreign material are seen on the SX film, but no copper or lead were found by EDX.

On the coat in the area of the defect and on the shirt in the area of the right front defect, the EDX gave a borderline count for copper. Iron, apparently from the blood stain was detected about the defect in the coat.

In regard to J.B.C. clothing:

It should be noted that the clothing had been subjected to dry cleaning at some time after the shootings. The validity of results may therefore be questioned.

One aberrant result, unexplained, possibly due to a misrecording of data or a temporary malfunction of the instrument (EDX) or perhaps an ephemeral contamination, was encountered. Re-analysis of the questioned area proved the aberrance. Copper was found in quantity in the region

of the defect in the right front. The results would indicate that the apparent borderline copper analysis is due to the lining containing some copper. Iron, apparently from blood, was still detectable near the right front defect in the coat, despite dry cleaning.

The analytical results are of interest, because there is proof of very little fragmentation of the missile (missiles) as it (they) passed through the person(s) of J.F.K. and J.B.C. Indeed, the only indication of copper in any quantity was in the region of the front defect of the coat of J.B.C. The term "in quantity" means only that copper was found in clearly detectable amounts by the use of the EDX equipment. The actual amount is very small, and the absence of particulate material on the SX film is not surprising.

I will not discuss further the relationship of these results to speculation or theory, but I would expect that the committee of Medical Consultants will be able to make good use of this information in helping to form a cohesive explanation of the assassination and attempted assassination.

Charles S. Petty, M.D.  
Medical Consultant



## ADDENDUM G

REPORT OF THE PHYSICAL EXAMINATION OF GOVERNOR JOHN R. CONNALLY—MEMORANDUM BY MICHAEL M. BADEN, M.D., TO THE HOUSE SELECT COMMITTEE ON ASSASSINATIONS, DATED SEPTEMBER 6, 1978

## MEMORANDUM

To: Gary Cornwell, Esq.

From: Michael Baden, M.D.

Date: September 6, 1978.

Re Physical examination of Governor John Connally.

Pursuant to your arrangements I met with Governor Connally on September 6, 1978, at 2:05 p.m. in room 772 of the Mayflower Hotel in Washington, D.C. Also present were Mrs. Connally; Mr. Julian Reed, an associate of the Governor who had been with him on the day of the assassination of President Kennedy; and Mrs. Ida Jane Ross of your staff.

The Governor was very cooperative, but rushed, to catch a plane.

On removing his shirt, it was readily apparent that at the site of gunshot perforation of the upper right back there is now a  $1\frac{1}{8}$ -inch long horizontal pale well healed scar that is up to  $\frac{3}{8}$ -inch wide centrally, with a lateral border slightly lower than the medial border (about 5 degrees). The medial margin is one-half inch superior to and five-eighths inch medial to the apex of the right posterior axilla. The lateral border is 6 inches to the right of the midline of the back and  $4\frac{3}{4}$  inches below the shoulder line.

There is a thin vertical surgical scar 1 inch long in the right midback region, 3 inches below and 3 inches to the left of the above described horizontal scar; approximately 20 degrees from the longitudinal with the upper border more medial.

The exit wound scar is in the right front chest 1 inch below the central nipple line and has been incorporated in a surgical scar that is  $9\frac{1}{2}$  inches long that extends from 3 inches to the right of the midline, 1 inch beneath the nipple line and proceeds superiorly to the right upper posterior axillary area.

Positioning the Governor while erect in the anatomic posture shows the missile track to proceed from back to front, downward at approximately a  $45^\circ$  angle to the horizontal and slightly medially at approximately a  $10^\circ$  angle for a distance of  $12\frac{1}{2}$  inches through the body.

Examination of the right wrist shows the gunshot wound of entrance to be incorporated into a well-healed surgical scar on the lateral aspect of the distal forearm slightly dorsally and extending to the wrist; there are well healed fine surgical scars on the ventral aspect of the wrist horizontally and longitudinally.

The examination was completed at 2:25 p.m.

ADDENDUM H

REPORT ON THE X-RAY BACK SCATTER AND SCANNING ELECTRON MICROSCOPY AND  
ENERGY DISPERSIVE X-RAY OF TISSUES OF JOHN B. CONNALLY, PREPARED BY  
SOUTHWESTERN INSTITUTE OF FORENSIC SCIENCES, DALLAS, TEX., DATED  
AUGUST 29, 1978

X-ray Back Scatter with Scanning Electron Microscopy  
and  
Energy Dispersive X-ray of Tissues of J.B.C.

8/24/77 and 8/28/77

Southwestern Institute of Forensic Sciences at Dallas

Charles S. Petty, M.D.  
Director

Report of 8/29/78

Special analyses using scanning electron microscopy equipment fitted with x-ray back scatter detector and energy dispersive x-ray were undertaken on the tissues which had been removed from the right wrist and the left thigh of John B. Connally at the time of debridement on 11/22/63. The surgical pathology report signed by Vernie A. Stembridge, M.D. is numbered S63-6750. The description is of three specimens and the microscopic examination of the three slides made from these three specimens.

Doctor Vernie A. Stembridge was contacted by me and delivered to me not only the three microscope slides prepared from the specimens removed from John B. Connally, but also the remaining tissue embedded in paraffin which had still been preserved.

The three microscope slides were examined and no evidence of metallic fragments was noted either by direct observation or by seeing evidences of tearing of the tissue which might have occurred as a result of the nicking of the microtome knife due to contact with metallic fragments that would occur during the preparation of the microscope slides.

The paraffin blocks containing the tissues from the debridement were then subjected to energy dispersive x-ray analysis. No evidence of copper lead, zinc, or nickel was found.

After preparation the paraffin blocks containing the tissues removed at the time of debridement and still remaining following the preparation of microscope slides were subjected to analysis using a scanning electron microscope fitted with a low angle detector for x-ray back scatter. No copper, lead, zinc, or nickel was found by means of this analysis.

It should be noted that the analyses undertaken were completely nondestructive and the tissues contained in the paraffin blocks and the microscope slides themselves have been retained, awaiting further instructions regarding disposition.

Charles S. Petty, M.D.  
Medical Consultant



## ADDENDUM I

Interviews conducted by the House Select Committee on Assassinations staff and/or the medical consultants with: Dr. J. Thornton Boswell, Dr. C. James Carrico, Dr. Norman Chase, Dr. James J. Humes, Dr. Marion T. Jenkins, Dr. John K. Lattimer, Dr. Malcolm O. Perry, Dr. Jack Reynolds, Dr. William B. Seaman, Dr. Robert R. Shaw, and Dr. George T. Shires.

Not included: Dr. Pierre A. Finck and Dr. John H. Ebersole were deposited by the select committee on March 11, 1978.

INTERVIEW OF DRs. JAMES J. HUMES AND J. THORNTON BOSWELL BY THE FORENSIC PATHOLOGY PANEL, SUBPANEL OF DOCTORS HAD NOT REVIEWED THE AUTOPSY MATERIALS PREVIOUSLY

## NATIONAL ARCHIVES

SEPTEMBER 16, 1977.

Physicians present were: Dr. Coe, Dr. Davis, Dr. Baden, Dr. Humes, Dr. Boswell, Dr. Petty, Dr. Rose, Dr. Levine, Dr. Loguvm, and Dr. Angel.

Staff members present were: Gary Cornwell, Kenneth Klein, Andy Purdy, Jim Conzelman, Lillian Johnson, and Chellie Mason.

L. JOHNSON. First, I'd like to ask everyone to state their name clearly, distinctly as possible for the record please.

G. CORNWELL. Well, just for her purposes, do you want to tell her what your names are—she doesn't know all of you—so that she can make a record of who's asking, or whatever, so that we would have the names.

Dr. BADEN. The principal speakers would be Dr. Petty, Dr. Humes, and Dr. Boswell; you have those. I think anybody else who talks will identify themselves to you and to the doctors.

G. CORNWELL. And, the man who just spoke to you is Dr. Michael Baden. The only statement that I wish to make in advance is that Dr. Humes and Dr. Boswell have come here voluntarily, not by subpoena, and simply because the other doctors thought there was some information that might be of assistance to them in their deliberations. We have decided that because of that fact, that it was the doctors' request that they come, and Dr. Humes and Dr. Boswell have come voluntarily, the staff will ask no questions, and you all just proceed as you see fit.

Dr. HUMES. I'd like to comment that we're pleased to be here and I for one welcome the investigation and I hope that it will ultimately, through all facets of it, erase the doubts that exist in the public's mind, the minds of Congress and others. Any help we can give, we are delighted to do so.

G. CORNWELL. Thank you very much, and I'm sure that's not only the staff's but all the doctors here sentiments exactly.

Dr. BADEN. I would just like to thank Dr. Humes and Dr. Boswell for coming here on such short notice to help in our interpretations.

Dr. PETTY. I'll use your last names so that it will come out right in the record rather than your first name, Dr. Humes, we, all of us here, are forensic pathologists, and we've all been faced with the same problems you were faced with on the night of the autopsy; we know perfectly well what pressures you were under, and this is in no way critical of anything that was done; we're only interested in certain information which we hope you have stored up in your association tracks and will be able to give us to help unravel some of the mystery and mystique that surrounded this thing. First of all, let me start with the question that was on the lips of everyone here and that is, did you or didn't you look at the adrenals?

Dr. HUMES. I would ask, you—did that bear, or does that bear, on your investigation of the event that took place that night?

Dr. PETTY. No; all we were wondering was—we noticed that that was noticeably absent from the autopsy report.

Dr. HUMES. Since I don't think it bore directly on the death of the President, I'd prefer not to discuss it with you doctor.

Dr. PETTY. All right. Fine. If you prefer not to, that's fine with me. We were just curious because normally we examine adrenals in the general course that the autopsy, as we undertake it. OK, so—

Dr. HUMES. I'd only comment for you that I have strong personal reasons and certain other obligations that suggest to me that it might not be preferable.

Dr. PETTY. All right. Second, did you ever see a piece of bone which was picked up apparently at the site of the assassination, retained for some period of time, and then submitted to the FBI?

Dr. HUMES. No; the only extra piece of bone brought to us then—that was contained in the casket that brought the President to us—was a piece of bone that was brought to us later on that evening; and the time, as you imagine, I wouldn't wish to guess, but I would have guessed it was midnight or 1 o'clock in the morning, Jay, something like that.

Dr. PETTY. And there are X-rays of that?

Dr. HUMES. Yes.

Dr. PETTY. We have X-rays of that; I think there are three fragments of bone actually, one large and two small.

Dr. HUMES. Those were the only other fragments I've ever seen.

Dr. PETTY. Well, we have photographs of a piece of bone that was retrieved from Dealey Plaza—is that the name of it—

Dr. HUMES. Yes.

Dr. PETTY. By a premedical student, as I understand it, a fellow by the name of Harper; it was retained for some time and then eventually found its way into the chain of evidence, and what I think the basic question is that we are asking—could this showing photographs—and this is a 1 to 1 photograph—could this have been missing from President Kennedy's skull or not?

Dr. HUMES. In my opinion it could because there was far insufficient bone to close the calvarium area. In fact, we spent many hours using rubber dam and other artificial materials to do that.

Dr. PETTY. Yes, this photograph that we're showing you is a color photograph of a fragment allegedly recovered by a Mr. Harper at the site of the assassination, and it contains a ruler in it, and it's a 1 to 1 color photograph of the fragment. The fragment is no longer available as we understand it.

Dr. HUMES. I comment further, Dr. Petty, that it's approximately the size, I would think, if you would compare it, with the photographs of that, larger than other fragments that were brought to us.

Dr. PETTY. I don't know how much distortion there is in this X-ray of the larger of the fragments that was brought to you.

Dr. HUMES. We are looking at X-ray No. 4 which is of three bony fragments, and our comment is that the color photograph that you show us of a fragment we did not see sort of approximates in size the fragments that were represented that evening, and to further restate, there were sufficient fragments missing that that fragment could have been.

Dr. PETTY. So even though this fragment picked up by Harper, measuring some 2½ inches in greatest dimension, even that fragment could have been put into the vacant areas in the scalp area as you've reconstructed it.

Dr. HUMES. Correct.

Dr. PETTY. Well, that's the major question I think that we wanted to have answered at this time. The second question or questions, series of questions, revolve about these photographs here which are Nos. 44 and 45. There may be a clearer one than this—was the clearer one in black and white? These are the color photographs, Nos. 44 and 45, and this area which I'm pointing to with my finger here seems to be an area which is almost semicircular in shape and appears to have beveling to the outside of the skull. Now, what we really want to know is where was this located, and in order to give you a chance to show it, where would this be on this skull here that I'm showing you?

K. KLEIN. Doctor, the photograph that you are referring to is what number?

Dr. PETTY. Nos. 44 and 45.

K. KLEIN. The particular one you're talking about now is?

Dr. PETTY. 44.

K. KLEIN. 44.

Dr. PETTY. And this is shown more clearly on the black and white photographs Nos. 17 and 18, probably best in No. 17, and I'm putting my finger on the same spot.

Dr. HUMES. Well, to the best of my recollection, and I regret that these photographs are so poorly marked, this was in the right parietal region approximately here.

Dr. PETTY. Could it have been forward of the suture line—what do you call it?

Dr. BADEN. Coronal.

Dr. PETTY. Could it have been anterior to the coronal suture line? Now these are our major questions on this.



Dr. HUMES. To state what the problem was, the basic problem was, as we reflected the scalp, various fragments of bone, some fell into the cranial cavity, some came to the table, some adhered to dura and so forth, that it was in—that it was on the right side, that it was parietal frontal, there's no question. Now, to tell you was it anterior to the coronal suture or not, I can't tell you unless that's a coronal suture in that photograph.

Dr. PETTY. Well, we would think perhaps this gap on photograph 26, this gap that is tending down toward the President's right ear—this V-shape directed toward the President's right ear—is the same as this V-shape gap—

Dr. BOSWELL. I believe it is.

Dr. PETTY. On your black and white No. 18.

Dr. BOSWELL. The scalp was so torn and lacerated that we never had to do any dissection there. The scalp was just laid over, and I believe that this is the scalp laying over here. As I interpret this; this is the shoulder down here.

Dr. PETTY. Cheek and shoulder.

Dr. BOSWELL. Yeah, and, that this is just laid down, like so, without having done any dissection or anything.

Dr. PETTY. So this would be the right temporal area?

Dr. BOSWELL. Now whether this was prior to or after removal of the brain tissue, I don't know.

Dr. HUMES. It would be after.

Dr. BOSWELL. I'm not sure that we haven't—that the head isn't back in such manner. I think that is probably taken just to show the magnitude of the wound.

Dr. PETTY. Yes, you're talking about color photograph No. 44 now. Well then, if I may ask one further question along this line, you will note on color photograph No. 26, just ahead of this V-shaped notch, there is a hank of hair which obscures everything, and the question that I'd like to propose now is, is that hank of hair obscuring this externally beveled portion of bone that we see in black and white No. 18?

Dr. HUMES. All I could tell you is that it could, Dr. Petty. It could have because these obviously in time were taken—these black and white photographs, both 18, were taken temporally that evening at a later hour than was this color photograph No. 26, in this case.

Dr. BOSWELL. These two are essentially identical though.

Dr. PETTY. Which two, would you just identify them for the—

Dr. BOSWELL. No. 44 color and No. 17 black and white. These are almost identical, and I would assume that one was taken with one camera and then the other one with another camera at the same time.

Dr. HUMES. What? The color negative may have been developed, may have been printed black and white, Jay. Looks more like that to me.

Dr. BOSWELL. Might have been. So they may be actually the same photograph.

Dr. HUMES. I think they are.

Dr. PETTY. That was the major question that we had because we're trying to establish if we can identify the point of outshoot of one or both of the fragments to the best of our analysis.

Dr. HUMES. One or both of what fragments?

Dr. BADEN. The bullet fragments.

Dr. PETTY. To the best of our analysis, we could not place which side of the coronal suture line—we couldn't place whether this is on the anterior side of the coronal suture or whether it's on the posterior side of it.

Dr. BADEN. The X-ray you took of the fragment that you received does show a suture line on it, so that's helpful in—

Dr. HUMES. Yeah. See, we felt that this area, this one semi-circular area on X-ray No. 4, quite likely was at least in part the other side of a circle; that was our interpretation of this fragment, and I don't think even that would have been quite complete.

Dr. PETTY. Well, we were wondering if maybe the new fragment which was picked up by Harper might make that circle complete somewhere if it's possible. Now, we don't know where this fragment is at this point.

Dr. HUMES. I don't see anything with quite the circumferential margins of these other—

Dr. PETTY. I am showing you now—I don't know if these photographs are marked, are they? This is a black and white enlarged photograph of Harper's fragment labeled number No. 9 or No. 6—I can't tell you which it is.

Dr. BADEN. It's No. 9.



Dr. PETTY. Probably No. 9. And this would be the internal surface of the fragment, and then on the other photograph which is the external surface, we were just wondering if this could help put a periphery or help complete the periphery of the gap there?

Dr. HUMES. Caused by the missile egressing the coronal wall?

Dr. PETTY. That is correct.

Dr. HUMES. I don't think so. I don't think any of the borders of this fragment to me would coincide with this type of a wound of exit.

Dr. PETTY. I see what you're driving at.

Dr. HUMES. One could almost imagine it to be elliptical, slightly elliptical or circular or which ever way. Might be hard to put any of the margins of this fragment there.

Dr. BADEN. How about the lateral skull film with regard to the location of that? Is that not helpful to you?

Dr. BOSWELL. It is somewhat helpful, yes. You want to throw that one up?

Dr. BADEN. While you are looking at that and for the record, Dr. Boswell, when you had discussed No. 44 color, the stenographer wanted to get down whether you said that the shoulder and cheek were visible in the photograph?

Dr. BOSWELL. Yes, shoulder and cheek.

Dr. DAVIS. Well, you can see why we say that the fragment that you show us could have helped to close the wound and still have room for more.

Dr. PETTY. I'm now looking at No. 2, X-ray No. 2. Is this the point of entrance that I'm pointing to?

Dr. HUMES. No.

Dr. PETTY. This is not?

Drs. HUMES and BOSWELL. No.

Dr. PETTY. Where is the point of entrance? That doesn't show?

Dr. HUMES. It doesn't show. Below the external occipital protuberance.

Dr. PETTY. It's below it?

Dr. HUMES. Right.

Dr. PETTY. Not above it?

Dr. BOSWELL. No. It's to the right and inferior to the external occipital protuberance.

Dr. PETTY. O.K. All right. Let me show you then color photograph No. 42, which then is the—

Dr. HUMES. Precisely coincides with that wound on the scalp.

K. KLEIN. Could you describe that point that you just made?

Dr. HUMES. That's an elliptical wound of the scalp which we described in our protocol. I'm quite confident. And it's just to the right and below by a centimeter and maybe a centimeter to the right and maybe 2 centimeters below the midpoint of the external occipital protuberance. And when the scalp was reflected from there, there was virtually an identical wound in the occipital bone.

K. KLEIN. And what number photograph is that?

Dr. HUMES. Forty-two.

K. KLEIN. Forty-two.

Dr. PETTY. Then this is the entrance wound. The one down by the margin of the hair in the back?

Dr. HUMES. Yes, sir.

Dr. PETTY. Then this ruler that is held in the photograph is simply to establish a scale and no more?

Dr. HUMES. Exactly.

Dr. PETTY. It is not intended to represent the ruler starting for something?

Dr. HUMES. No way, no way.

Dr. PETTY. What is this opposite—oh, it must be, I can't read it—but up close to the tip of the ruler, there you are two centimeters down.

Dr. BOSWELL. It's the posterior-inferior margin of the lacerated scalp.

Dr. PETTY. That's the posterior-inferior margin of the lacerated scalp?

Dr. BOSWELL. It tore right down to that point. And then we just folded that back and this back and an interior flap forward and that exposed almost the entire—I guess we did have to dissect a little bit to get to—

Dr. HUMES. To get to this entrance, right?

Dr. BOSWELL. But not much, because this bone was all gone and actually the smaller fragment fit this piece down here—there was a hole here, only half of which was present in the bone that was intact, and this small piece then fit right on there and the beveling on those was on the interior surface.

Dr. PETTY. Then was this below the tentorium or above the tentorium on the inside? Do you recall?

Dr. HUMES. Everything was so disrupted, I'm not sure.

Dr. BOSWELL. Well, the dura was completely—as you can see here—was completely destroyed practically, and I don't think there were any markings that were really very adequate to see where it was related to the tentorium. I don't see a picture.

Dr. PETTY. It happens to be on 42, a fine line going to—is that fine line going to the area you identify as the—

Dr. HUMES. That's an artifact of some kind.

Dr. PETTY. Fine.

Dr. HUMES. Right there (pointing to photograph No. 42).

Dr. PETTY. Now, if it goes in at the point indicated below the external occipital protuberance, then it is going to go in about at the tentorium.

Dr. HUMES. At the tentorium, I'm saying, Dr. Petty. Approximately, but you see—

Dr. BADEN. I think the record should reflect that Dr. Angel just arrived and is being greeted.

Dr. COE. Dr. Humes, looking at photograph No. 46, I am curious to know whether this destruction you feel is a postmortem artifact in removing the brain, or was part of this, was caused by the bullet you think perhaps? You have a junction between the cerebellum and the—

Dr. HUMES. No; well, I think it was partly caused by the bullet.

Dr. COE. It was?

Dr. HUMES. It was great—it was a tearing type of disruption that basically had to go back to our description. The corpus collosum was torn, was it not Jay? And the midbrain was virtually torn from the pons.

Dr. COE. Thank you all.

Dr. HUMES. Now don't misinterpret me that the missile necessarily passed through there because it was a great—

Dr. COE. But it must have come fairly close in there.

Dr. HUMES. Could have, yeah.

Dr. PETTY. Mark from the point of view where it entered.

Dr. HUMES. Yes, sir.

Dr. BADEN. Pursuing the question Dr. Coe has been asking, I am looking at photograph No. 50 of the brain, the dorsum of the brain. Question has arisen relative to a purple object in the right frontal cerebral region as being a foreign object. Do you have any thoughts you can give us about that object? And here is No. 46, which is the undersurface of that same area.

Dr. HUMES. I strongly suspect that this foreign object is something that was placed on the table in an attempt to elevate this portion of the brain so it wouldn't be as much out of focus. I think you're looking at a defect in brain substance because, you know, if you try and take a picture with a surgical specimen or what have you, and different portions of it are at different levels—I think we made an attempt. That certainly was not present in the brain, and I interpret that we took some object that was immediately available in the room and placed it under the brain in an attempt to bring the right cerebral hemisphere somewhat closer in level to the left for the photograph.

Dr. BADEN. You are completely satisfied—and Dr. Boswell—that there was no foreign object in this area?

Dr. HUMES. Absolutely, unequivocally, without question.

Dr. BOSWELL. Yes.

Dr. PETTY. Dr. Angel, we have two photographs here representing what appears to be a skull fragment which was recovered by one Harper at Dealey Plaza some little time after the assassination took place. We would like very much to have your expertise in identifying where this particular fragment of skull might have arisen, that is, what part of the head bone it came from?

Dr. ANGEL. Well, it's clearly parietal bone, side left or right is not so easy. You can see one, two, or three markings for meningeal vessels on the inner surface. This is the same—

Dr. PETTY. This is the same thing blown up there, both sides are shown.

Dr. ANGEL. Shown very clearly, as well as some blood vessels entering—the damage on the outside looks as though there's still some pericranium the hairing on the outside, but I'm not really sure about that, it's got a ragged edge there. I don't think I can say anything really much sharper than that; my feeling is that it was on the outside and that it's—oh—around here.

Dr. PETTY. Around where?

Dr. ANGEL. Around this area here, below the parietal bone and directly above the sagittal suture. I, at first I could see marks of sagittal suture here, but I don't think that's it.

Dr. BADEN. We also have the negatives from which these were made.

Dr. ANGEL. Well, excuse me—it doesn't seem to show on the inside. I'm puzzled.

Dr. PETTY. Now, they want us to record which photographs you're examining again. And these once again for the record are photographs of the segment or fragment of bone picked up by Harper at Dealey Plaza.

Dr. BADEN. Right, and photograph Nos. 13 and 8 and the two color prints are being examined by Dr. Angel at this time.

Dr. ANGEL. Are you sure that's suture edge there?

Dr. BOSWELL. Yes. We're not sure; we ask for your advice.

Dr. DAVIS. That's why you're here, sir.

Dr. BADEN. Would you like to see the kodachromes?

Dr. ANGEL. I'm not sure that isn't simply a broken edge.

Dr. BADEN. I'm sorry we don't have a better way of viewing them.

Dr. HUMES. There's an X-ray view box, Dr. Angel; might help.

Dr. ANGEL. No; I don't think those things are going to help. See, I don't think you can have this be the coronal suture because then you would certainly have the entry of a branch of the meningeal artery, some remnant of that tree going up there along it. And I thought these were intermediate posterior branches of middle meningeal going up the side of the parietal here—I would have interpreted the piece as fitting here and I would have looked here for a trace of lambdoid suture. Now this inner surface is broken away. Perhaps that could be the very edge of the coronal suture on the right, but of course I don't know what damage the skull showed and whether this has to be—but I'm not supposed to know this.

Dr. BADEN. No, Dr. Angel; feel free to discuss this with Dr. Humes who did the autopsy. He'd be delighted to—

Dr. ANGEL. Is there a defect on the right that this would fit into?

Dr. HUMES. Good, Dr. Angel. Yes.

Dr. COE. Yeah. There's a picture right there in color that would show you the extent of the—

Dr. HUMES. Could you put that lateral view of the skull up again for Dr. Angel's benefit? Dr. Angel, there was a massive defect of the skull from the right, and there was a portion of the right parietal-temporal bone still attached to the skull. Where is the picture? Here—at one margin—and later on in the evening—

Dr. PETTY. Let me identify this for everybody here. This is color photograph No. 44.

Dr. HUMES. There was what we interpreted to be an exit wound, in the location to which I point. The bone that would correspond and complete that circle or ellipse, that might have been made by that exit wound, was missing at the time we began the examination. Later on that evening, several hours into the evening, we were presented with another fragment of bone, not the one that you are examining now, and that fragment had a corresponding semicircular defect which almost completed this, what we interpreted to be an exit wound, but not quite. And we never had the privilege of examining the fragments or photographs of this fragment that you now examined until this afternoon, and I was unaware of its existence until about 3 weeks ago.

Dr. PETTY. This is a fragment that arrived quite a while later in a Nieman-Marcus box.

Dr. HUMES. It never arrived to our knowledge. Dr. Angel, I draw your attention to the view box where you get some comprehension of the size of the defect.

Dr. BOSWELL. These are all slightly different views, slightly different. They are all different pictures, so that I'm not sure.

Dr. ANGEL. No; I don't think—don't know if that makes any major difference—

Dr. PETTY. Dr. Angel, let me show you also this X-ray film of the three fragments that were separate and detached from the body which had been X-rayed here. One of these three fragments—the larger of the three—is the one that apparently helped complete a portion of an outshoot wound, is that correct, Dr. Humes?

Dr. HUMES. That was our opinion, Dr. Petty.



Dr. PETTY. You may want to put these together and have this up here too. One further question, Dr. Angel. There seems to be a suture line here on this larger of the three fragments.

Dr. ANGEL. Yes; that seems to be quite clear.

Dr. PETTY. Could that be the coronal suture?

Dr. ANGEL. I would have guessed that it might be. Again, I don't see any meningeal vessel markings, but if this exit wound is here and the coronal suture is going up like that, that's conceivable.

Dr. PETTY. Well, I think the question that we all have is whether this is anterior to the coronal suture or posterior to it.

Dr. ANGEL. Oh, there was damage that far forward?

Dr. PETTY. I believe so. I think the damage is quite apparent here in the lateral view of the skull by X-ray.

Dr. ANGEL. Yes, that's right.

Dr. BADEN. And also on X-ray No. 1, the anterior-posterior view, right side.

Dr. ANGEL. Right. Well, this then could be frontal perfectly well. It doesn't show the meningeal markings, and that's what made me unhappy about it being, well—photo makes more sense—in that case the exit wound must be not very far above the right or near the right pterion, I would think.

Dr. BADEN. For the record, Dr. Angel you're viewing photographs Nos. 8 and 13 of bone and X-rays Nos. 1, 3, and 6 at the X-ray view box.

Dr. ANGEL. Now, that seems to have a little portion of that circle on it and the rest of that circle on this photograph.

Dr. PETTY. No. 44. Dr. Humes could probably tell more where that is than I can. This is the right cheek as I understand it, is that correct, Dr. Humes? And this then is the right shoulder and the flap turned back at the time of the autopsy?

Dr. HUMES. Yeah.

Dr. ANGEL. Well, this must be well forward then on the frontal bone, I was interpreting it as being—this itself as being near the pterion.

Dr. BADEN. Yet here is the gap.

Dr. HUMES. That is not frontal bone where that semicircle is—it's either temporal or parietal bone, Dr. Angel.

Dr. ANGEL. I don't see how it can be. That's what it looks like to me.

Dr. HUMES. That's exactly what it is.

Dr. ANGEL. In that case, I'm puzzled by the missing bone here and the angles. Is this to be placed more like this? Now this piece could fit on here and the parietal piece could fit behind that, this piece could.

Dr. PETTY. The Harper piece could be fitted posterior and slightly lateral is that what you're saying?

Dr. ANGEL. This is what I'm saying, yes, perhaps.

Dr. PETTY. Now, this is photograph No. 26, and it seems to show the pieces more as they were first viewed and to orient this photograph and the photograph No. 44.

Dr. BOSWELL. It's hard to do, Dr. Petty

Dr. PETTY. It's hard to do. But this is more or less what you're looking at, isn't it?

Dr. ANGEL. I think so, yes. I thought perhaps this was a little more tilted.

Dr. PETTY. Well, perhaps like that

Dr. HUMES. Negative, I don't think that's true.

Dr. ANGEL. What's bothering me is what part of the flesh is that?

Dr. PETTY. That's the cheek, the right cheek.

Dr. ANGEL. If that's the right cheek then it can't be—has to be more or less.

Dr. PETTY. Yeah.

Dr. ANGEL. It's really hard to be sure, square this with the X-ray which shows so much bone lost in this right frontal area.

Dr. PETTY. Well, I think there may be more bone apparently lost than is actually lost in the X-rays. We don't know when those X-rays were taken. Dr. Humes, do you by chance know at what phase of the autopsy the X-rays were taken? Were these taken before the brain was removed or after?

Dr. HUMES. Yes. All of the X-rays were taken before any manipulations were performed.

Dr. BOSWELL. Some of the bone fragments though, are partially extruded, as we see in X-ray No 1.

Dr. HUMES. Some of them were adhered to partially torn scalp.

Dr. BOSWELL. Which accounts for some of the missing bone.

Dr. ANGEL. It's hard to do that—jigsaw puzzle—that's all I can say. I was looking somewhere here for a temporal line, and I can't see any clear indication of it. And that should be running up like that, and so it's hard for me to put these two—

Dr. PETTY. We believe that in photograph No. 44 the V-shaped notch here is the same as the V-shaped notch that you see in photograph No. 26. This then would give you the angle at which these two photographs should correspond and that would seem to fit pretty well.

Dr. ANGEL. So, in that case this exit wound is really in the frontal—its in front of that notch there—it's in the frontal, see what I mean, it would have to be about here.

Dr. PETTY. Would that suture line help at all?

Dr. ANGEL. Yes, this—if that's as it looks, like the piece of frontal bone that fitted here like that, and the wound is about here, that would fit.

Dr. BADEN. Now, would this be below the hairline, because this appears above the hairline?

Dr. ANGEL. It would have to be above the hairline.

Dr. BADEN. At this point?

Dr. ANGEL. Uh-huh. In that case this fragment here of parietal could very easily fit back here, looks like there's another fragment in here. See what I mean.

Dr. PETTY. Well, it's terribly fragmented, and we can't really reconstruct it.

Dr. BOSWELL. No, you can't recall—that's perhaps this piece of parietal, that sharp edge there could conceivably have fitted on here behind this fragment—looks as though it's the front part, front lower part, anterior-interior portion of the right parietal.

Dr. ANGEL. I would interpret this as being, originally, as being roughly the middle of the right parietal, and I still think so.

Dr. PETTY. Our ultimate question is, do you think this could well be part of the skull of the late President, referring now to the Harper piece?

Dr. ANGEL. Yes.

Dr. PETTY. And you think it would fit also, don't you, Dr. Humes?

Dr. HUMES. Yes. I have great difficulty in orientation of Nos. 44 and 45, Dr. Petty, and I share your problem, and I'd like to spend some time with it, but I have great difficulty.

Dr. ANGEL. So do I. I wish the hair were not obscuring that notch because I think that's where it has to be. If that V is the same as this, it has to be somewhere around here.

Dr. BADEN. The hairline would be where the skull fragment is missing?

Dr. ANGEL. It's not too—that would be just about at the hairline or just above it—and then in front of the temporal line, which I couldn't see, that was what was bothering me. And I couldn't see any temporal line here, and if the temporal is—if this is really the forehead, this scalp directed down as it ordinarily would be, then that makes sense.

Dr. PETTY. I believe it is the forehead, and the scalp is reflected down.

Dr. ANGEL. Yeah. I think that makes sense.

Dr. PETTY. Dr. Humes, would you buy that here is the scalp of photograph No. 44 and reflected down over the face? Right here?

Dr. HUMES. Yes.

Dr. PETTY. And that this then really could very well be the frontal portion?

Dr. HUMES. Right. Now I'm much happier. I will buy that completely. That's where that was.

Dr. PETTY. OK, well—this makes more sense to me.

Dr. HUMES. We reflected the scalp here. This is the exit wound where I thought it was. This is the back of his head here. This is the back of his shoulder.

Dr. PETTY. These two are lined up just about right now. See, this notch is pointing in the same direction here, and this would be in the frontal area and anterior to the coronal suture in all probability.

Dr. HUMES. Right.

Dr. PETTY. Do you see that, Dr. Davis? That this then would be in the frontal bone and anterior to the coronal suture?

Dr. DAVIS. Which I think is consistent with the X-rays, the lateral films, and fits in with our interpretation.

Dr. PETTY. Now, may I ask you one other question on this X-ray, Dr. Humes. Here is a view taken, I assume, with the radiation point above the face and the film behind the back of the head.

Dr. HUMES. Not being a radiologist, I presume that.

Dr. PETTY. If that's true, then the least distorted and least fuzzy portion of the radiopaque materials would be closest to the film, and we would assume then that this peculiar semilunar object with the sharp edges would be close to the film and therefore represent the piece that was seen in the lateral view—

Dr. HUMES. Up by the eyebrow.

Dr. PETTY. No. Up by the—in the back of the skull.

Dr. BADEN. Could you state the numbers of the two X-rays that you're talking about?

Dr. PETTY. Yeah. I'm sorry, I keep forgetting these numbers. We're looking at roentgenogram Nos. 1 and 2. The first is an anterior-posterior view of the head, the second is a lateral view, and we're trying to establish whether this particular sharp-edged radiopaque defect is close to the back of the skull or close to the front of the skull.

Dr. HUMES. I can't be sure I see it in the lateral at all, do you? Do you see it?

Dr. BOSWELL. Yes, right here.

Dr. PETTY. Were these fragments that we see recovered at all?

Dr. BOSWELL. No; they were not.

Dr. PETTY. I can understand why they weren't.

Dr. BOSWELL. I think there were three or four tiny little pieces, and I think those are here in the Archives.

Dr. HUMES. The X-ray, as you know, doesn't tell me how large that was or what its bulk or mass was. Most of the fragments that we recovered were grains of sand-type fragments.

Dr. BOSWELL. Yeah, millimeter or so.

Dr. HUMES. I don't recall them of that size.

Dr. PETTY. So that placing the outshoot wound in the right frontal bone toward the coronal suture is probably about where it was.

Dr. HUMES. Uh-huh.

Dr. PETTY. Joe Davis, you have questions, I think, about the inshoot area, don't you?

Dr. DAVIS. Well, in terms of the inshoot, my impression when I first looked at these films was that the inshoot was higher, and I equated that with the lesion in photograph, I believe it was No. 26, color photograph—well, it's 43—and I interpreted—which one is this?

Dr. BADEN. This is No. 42.

Dr. PETTY. We were wondering if that had been the inshoot.

Dr. HUMES. No, no, That's no wound.

Dr. DAVIS. Because in No. 42 I interpreted that as a wound, and the other, lower down in the neck, as just being a contaminant, a piece of brain tissue.

Dr. HUMES. No, that was a wound, and the wound on the skull precisely coincided with it.

Dr. DAVIS. Now it was a tunnel—

Dr. HUMES. Yeah, tunnel for a way.

Dr. BOSWELL. Yeah, it's longer than it is wide, and tunneled along and actually under here, and then at the actual bone defect was above the—

Dr. HUMES. And this photograph No. 45, I am quite convinced, is an attempt to demonstrate that wound, and not a very successful one I'm afraid, because I can't for sure pick it out. This, I believe, was taken looking down at the inside—looking close to the posterior cranial fossa.

Dr. BOSWELL. And what we see here is a lot of red and fragments of bone.

Dr. COE. Dr. Humes and Dr. Boswell, have you discussed these photographs with the other pathologists who have previously gone over this with you?

Dr. HUMES. I have not.

Dr. BOSWELL. I went over the photographs with Humes.

Dr. COE. Because at least there's already one of them right—I had the impression that they apparently thought—I was just curious as to—

Dr. HUMES. Our written description clearly, I think, indicates that point right there.

Dr. COE. But they describe, some of them, the entrance they feel being 10 centimeters above the occipital protuberance.



Dr. PETTY. Well, there have been all sorts of changes from the original—I mean, right and left and up and down.

Dr. COE. No. That's why I was interested in whether they had discussed it with the pathologists or whether the pathologists had been interpreting entirely from the photographs when they made the statement.

Dr. PETTY. So, on photograph No. 42, then, down right at the hairline, right at almost in the midline, is the inshoot wound, and this photograph is not taken with the inshoot wound centered in the photograph, but rather the posterior extension of the scalp tear is the subject of the photograph.

Dr. HUMES. Again, to be sure that it was related to the gentleman's head rather than focusing specifically on a wound, no I don't think we took the photograph specifically at that site, do you, Jay?

Dr. BOSWELL. No.

Dr. PETTY. And, you say, Dr. Boswell, that the bullet entered the skin and that the wound in the skull was a little above that.

Dr. BOSWELL. Right.

Dr. PETTY. Because apparently the bullet had tunneled a little under the skin and then that corresponds with the diagram that I saw which showed a point on the back of the body, the diagram with an arrow pointing upward and slightly to the left.

Dr. HUMES. You caught—I don't know what you are referring to.

Dr. BADEN. Could I interrupt 1 second? Dr. Angel has to go at this point, but in summary, you are pointing to the skull. The X-rays and the photographs and the X-ray of fragments of bone that was taken by Dr. Humes during the autopsy would indicate that the exit perforation is where?

Dr. ANGEL. Along in here I think, above the temporal line, and that triangular fragment I think would fit from—just short of the fragment down to the edge of the exit perforation and then across this way, fitting in as sort of a triangle in the upper part of the frontal—so I think that's the best fit that I could estimate from seeing the X-rays.

Dr. BADEN. And this would place the exit gunshot wound just anterior and almost incorporated into the lateral aspect of the coronal suture line.

Dr. ANGEL. A little in front of it, yes.

Dr. BADEN. Then it's slightly in front of and just superior to the temporal bone.

Dr. ANGEL. Apparently above the hairline. His hairline was fairly low; he wasn't getting bald like me. So, I think an exit wound about there would fit, then, the fragment that you have.

Dr. BADEN. Just anterior to the coronal suture line?

Dr. ANGEL. Just anterior to the coronal suture line, yes. Well above pterion, far above pterion near the point where the temporal line crosses the coronal suture.

Dr. BADEN. Do you have a name for it?

Dr. ANGEL. Stephanion.

Dr. BADEN. I think we should also record that Dr. Angel graciously came over at a moment's notice to help us with these interpretations, and we're most grateful.

Dr. ANGEL. Thank you very much, doctor.

Dr. PETTY. Dr. Boswell, this is the diagram that I was referring to a moment ago where the point of—

K. KLEIN. Could you identify in some way what it is?

Dr. PETTY. The face sheet of Dr. Humes' protocol.

K. KLEIN. OK.

Dr. PETTY. Which shows an inshoot wound on the back of the head and the arrow pointing upward and to the left—that just meant up.

Dr. BOSWELL. That just meant up. It wasn't intended to indicate direction or anything.

Dr. PETTY. And, do you know what this word is? It says "ragged," and the reproduction has lost something here. The next word I can't make out.

Dr. BOSWELL. I'm sorry, I can't either.

Dr. PETTY. OK, thank you very much.

Dr. COE. Dr. Boswell, was it the Clark commission or the Rockefeller commission?

Dr. BOSWELL. The physicians that you spoke with remember? Clark.

Dr. BADEN. Dr. Fisher and Dr. Moritz?

Dr. BOSWELL. Yes, right.

Dr. BADEN. At the break perhaps they can review the original notes and that will—

Dr. BOSWELL. "Ragged slanting" is what it says.

Dr. BADEN. And then we'll discuss that after the break.

[Coffee break.]

Dr. BADEN [continuing after the coffee break]. We were just discussing the original fact sheet document. Dr. Boswell, would you just explain what you wrote and what other people wrote on the front and back of that page?

Dr. BOSWELL. The weights of the organ are not written by me. Everything else on here is mine. All of the notes on the diagrams are mine, and this diagram on the back is mine, this and this.

Dr. BADEN. Could you explain the diagram on the back?

Dr. BOSWELL. Well, this was an attempt to illustrate the magnitude of the wound again. And as you can see it's 10 centimeters from right to left, 17 centimeters from posterior to anterior. This was a piece of 10 centimeter bone that was fractured off of the skull and was attached to the under surface of the skull. There were fragments attached to the skull or to the scalp and all the three major flaps. I guess the—I'm not sure in retrospect what I meant by that.

Dr. PETTY. May I ask you, Dr. Boswell, if this diagram depicts in anyway the same V-shaped notch that we saw on some of the color photographs, namely, and I have in hand, No. 27 here. Would this notch be the same as the notch that we see that points more or less toward the right ear?

Dr. BOSWELL. I believe so. And what this is meant to depict at this point, I don't know.

Dr. PETTY. Well, having gone through a lot of smashed skulls—injuries—I know precisely what you're grappling with.

Dr. HUMES. I think this—I would interpret this fracture through the floor of the orbit—

Dr. PETTY. Of the orbital cavity.

Dr. HUMES. Right. It was an explosion-type fracture.

Dr. PETTY. We also had a question about photograph number—is this 10 or is this 12?

Dr. BADEN. Twelve.

Dr. PETTY. This is the wound, right upper thoracic wall posterior. Is this small fragment of dark staining material simply blood?

Dr. BOSWELL. Blood, uh-huh.

Dr. PETTY. It's the one that's perhaps 4 or 5 centimeters below and to the left of the wound itself?

Dr. BOSWELL. Yeah. There was no damage there at all.

Dr. PETTY. Yes. This is the other photograph which is horribly blurred for reasons unapparent—this is photograph No 41—these two show the right anterior aspect of the head, neck and chest of the late President, and there is a notch which we see; it's very blurred and it really doesn't seem to be so much of a notch as a semicircular defect in the central portion of the—the inferior margin of this gaping wound. Is that what was considered to be a partial bullet wound?

Dr. BOSWELL. Of exit, yes. That was what we ultimately concluded, yes.

Dr. PETTY. The reason I specifically bring this up is that somebody somewhere along the line has changed this from the lower margin to upper margin, and we just couldn't see that.

Dr. HUMES. You see, Dr. Perry informed us that he went right through that wound to make his tracheostomy.

Dr. BADEN. We're talking about also photographs Nos. 13 and 14. Did—in further discussing the exit perforation through the tracheotomy, did you have occasion to explore in the neck area beyond what is in the protocol, beyond what the description was? As to what was injured?

Dr. HUMES. Well, the trachea, I think we described the irregular or jagged wound of the trachea, and then we described a contusion in the apex of the lung and the inferior surface of the dome of the right pleural cavity, and that's one photograph that we were distressed not to find when we first went through and catalogued these photographs, because I distinctly recall going to great lengths to try and get the interior upper portion of the right thorax illuminated—you know the technical difficulties with that, getting the camera positioned and so forth, and what happened to that film, I don't know. There were a couple of films that apparently had been exposed to light or whatever and then not developed, but we never saw that photograph.



Dr. BADEN. From the time you first examined them, that particular photograph was never seen?

Dr. HUMES. Never available to us, but we thought it coincided very neatly with the path that ultimately we felt that that missile took.

Dr. BADEN. Continuing with the path. There is present in the X-rays some opaque material to the right of the lower cervical spine which has been interpreted as being tiny bullet or bone fragments. Would the track, as you recall, be consistent with the missile striking a transverse process?

Dr. HUMES. Well, I must confess that we didn't make that interpretation at the time. I'm familiar with the writings of Dr. John Lattimer and of some reprints of his articles, and I'd have to go back and restudy it the way he has done. But as you can see from the point of entrance, it wasn't that far lateral. It could conceivably have nicked a—the edge of a transverse process.

Dr. PETTY. Now, it was tending further to the left as it went?

Dr. HUMES. Why sure, because it came out in the midline.

Dr. BADEN. Just for the record, you say it could have nicked?

Dr. HUMES. It could. I don't know.

Dr. PETTY. Can I go back to another interpretation which is very important to this committee? I don't really mean to belabor the point, but we need to be certain, as certain as we can be—and I'm showing you now photograph No. 15, and here, to put it in the record, is the posterior hairline or margin of the hair of the late President, and there, near the midline, and just a centimeter or two above the hairline, is an area that you refer to as the inshoot wound.

Dr. HUMES. Yes, sir.

Dr. PETTY. Also, on this same photograph is a ruler, and approximately 2 centimeters or so down the ruler and just to the right of it is a second apparent area of defect, and this has been enlarged and is shown to you in an enlargement, I guess No. 16, which shows you, right opposite the 1 centimeter mark on the ruler, this defect, or what appears to be a defect. I don't see the connection with the lacerated margin of the scalp anywhere.

Dr. BADEN. And No. 15 shows an enlargement of the lower area that's suggestive of an inshoot to you.

Dr. PETTY. And what we're trying to do is to satisfy ourselves that the bullet actually came in near the margin of the hair and not near the tip of the ruler as is shown in photograph No. 16.

Dr. HUMES. This is an enlargement from that other photograph, right?

Dr. HUMES. Dr. Boswell offered the interpretation that it might be an extension of a scalp wound. I don't share his opinion about that. I don't know what that is. No. 1, I can assure you that as we reflected the scalp to get to this point, there was no defect corresponding to this in the skull at any point. I don't know what that is. It could be to me clotted blood. I don't, I just don't know what it is, but it certainly was not any wound of entrance.

Dr. DAVIS. May I interject. I think perhaps it's time now for some correlations. We have here black and white copies of Zapruder film frames Nos. 311, 312, and 313. That's 313 at the moment when the head actually exploded, 311 and 312 being the position of the head immediately prior. We have these photographs here, and we have the lateral X-rays, X-ray No. 2. I think perhaps what we can consider is the problem of the tangential striking bullet which enters the head, tunnels—and that's already been testified to, and it seems reasonable—strikes the bone tangentially, fragments, and then one part of a fragment can skip out through the scalp again, which may explain this wound we see here in enlargement No. 16. Now the evidence for that on X-ray would be a trail of radiopaque spots which, with a magnifying lens, we can see in X-ray film No. 2 extending in an upward direction from the region of the external occipital protuberance, with the upper portion of this in an area where there's a large defect in the posterior parietal bone. Now, there is radiopaque material, some of which appears to be even exterior, at least in this view, with continuation of radiopaque fragments in the vertex part of the interior of the head, and also continues straight ahead, and I think there's some more down here in the mid-posterior area. So I think all of us who have done a fair number of investigations like this are well aware that a bullet can split into fragments and one fragment can be deflected outward, another fragment can be deflected inward and slightly upward, and even a third fragment can go straight. There's all sorts of things can happen with bullets when they strike in this manner. I think I can see radiopaque trails going up which could reconcile the testimony and opinion of Dr. Humes that this ma-



terial, this brain material, represents the loss of brain from the entrance site; and also it reconciles with his statement and also with Dr. Boswell's statement that there was tunneling; and I think it also fits in with Zapruder frames 311 and 312 immediately before 313, where the head explodes, in which in 311 and in 312 we see the President sitting, his chin is down, and it's hard to say which way the head is turned in this because these are black and white photographs and they are enlargements and they are slightly blurred. But it would be consistent, then, with the bullet striking, and we all recognize that this is fairly thick condensed bone, and that in itself would add to the propensity for a split bullet. So I'm advancing that as an investigative hypothesis for investigative opinion, for discussion at this time, to see if we can arrive at a consensus.

Dr. HUMES. I would like to comment further, from our point of view, that these enlargements which you have shown us now of these other photographs is the first time I have seen these enlargements; I have not seen them before.

Dr. DAVIS. These were just made up 2 or 3 days ago. Two days ago.

Dr. PETTY. May I make a comment on what you just said, Dr. Davis. The problem, as I see it, is that this may be in fact a tunneling situation, with the bullet scooting along the skull here or somewhere, and not entering the skull down below. Is that what you're saying now?

Dr. DAVIS. What I'm saying—what I'm inferring: in the absence of photographs and specific measurements, we could only conjecture as to how long the tunneling is, but I would envision this as a tunneling first and then entry into the skull.

Dr. LOQUVAM. Gentlemen, may I say something?

Dr. DAVIS. Yes.

Dr. LOQUVAM. I don't think this discussion belongs in this record.

Dr. PETTY. All right.

Dr. HUMES. I agree.

Dr. LOQUVAM. We have no business recording this. [This is for us to decide between ourselves; I don't think this belongs on this record.]

Dr. PETTY. Well, we have to say something about our feeling as to why we're so interested in that one particular area.

Dr. HUMES. Could I make a comment that I think would be helpful to you, and you can throw out anything I say or whatever? But I feel obligated to make a certain interjection at this point, having heard this theory which I hadn't heard from the committee because I didn't pay that much attention quite frankly. Our attention was obviously directed to what we understood and thought to be clearly a wound of entrance. If such a fragment were to have detached itself from the main mass of the missile, it would have to be a relatively small fragment because the size of the defect in the skull which approximated this point was almost identical with the size of the defect in the skin. Do you follow that line of reasoning?

Dr. PETTY. Yes, that makes sense. I mean, I've seen the same thing.

Dr. DAVIS. I've seen the same thing—bothers me a bit—part of that casing comes off.

Dr. COE. The reason we are so interested in this, Dr. Humes, is because other pathologists have interpreted the—

Dr. LOQUVAM. I don't think this belongs in the damn record.

Dr. HUMES. Well, it probably doesn't.

Dr. LOQUVAM. You guys are nuts. You guys are nuts writing this stuff. It doesn't belong in that damn record.

Dr. BADEN. I think the only purpose of its being in the record is to explain to Dr. Humes what—

Dr. LOQUVAM. Why not turn off the record and explain to him and then go back and talk again.

Dr. BADEN. Well, our problem is not to get our opinions, but to get his opinions.

Dr. LOQUVAM. All right then, keep our opinions off. Here's Charles and Joe talking like mad in the damn record, and it doesn't belong in it. Sorry.

Dr. BADEN. Dr. Humes, realizing our concerns, if there is anything that you or Dr. Boswell can say that can help clarify any further the entrance wound and track of the bullet in the head, we would be most appreciative.

Dr. HUMES. I think we're at a distinct disadvantage because, as I said, when we cataloged the photographs and numbered them, and spent half a day or day to do it, I'll confess to possibly even overlooking the area to which you gentlemen, and apparently someone else, has directed attention. I would not attempt to make an interpretation of what it represents because I can't at this point.

Dr. DAVIS. But at the time of the autopsy there was no defect in the scalp other than where the bone was gone.

Dr. HUMES. Right.

Dr. BADEN. When you say defect, you're talking about a defect of the wound of entry?

Dr. DAVIS. Right.

Dr. BOSWELL. Now, I'm sure that our record describes the tunneling of that wound of entry pretty well, at least as to length and distance beneath skin doesn't it? I can't recall the description, but I'm sure it is there.

Dr. HUMES. I'm looking for the color photograph that coincides with No. 15—which one is it?

Dr. BADEN. 42 is one.

Dr. HUMES. Yeah. Whether this "defect" is a "defect", in my mind, I'm not sure. I'm not sure it's not some clotted blood that's lying on the scalp.

Dr. BADEN. What we're trying to do is to have your best opinions and recollections to deal with.

Dr. HUMES. Right.

Dr. BADEN. Now, and much of this goes toward the head wound and also the neck wound, is there anything further about the wound of the back that exits the neck that you can recall independently relative to what isn't in the record, as when you described the trachea. Do you remember anything about the carotid arteries or the carotid sheath area?

Dr. HUMES. It had to have passed medial to the right carotid bundle.

Dr. BADEN. Medial. And was there a lot of hemorrhage in that area?

Dr. HUMES. There was moderate hemorrhage in the soft tissues.

Dr. BADEN. In the area of the trachea and that side of the neck?

Dr. HUMES. Right.

Dr. BADEN. George, is there anything further you'd like to add?

Dr. LOQUVAM. No, I've said my piece.

Dr. HUMES. Show me by photograph where the external occipital protuberance is?

Dr. DAVIS. I can't show you where it is on this photograph to my satisfaction.

Dr. PETTY. Well, the thing that we found—

Dr. HUMES. Let me have the written notes to be sure that it's not in the transcription.

Dr. BADEN. Here's the written notes.

Dr. BOSWELL. May I have these, what we're working with, OK? This is on page 4—

Dr. HUMES. These are medical wounds—

Dr. PETTY. Comes after missile wounds, considerable amount of missile wounds, then you get it.

Dr. BOSWELL. Situated in the posteris scalp approximately 2 centimeters laterally to the right, is that what it says?

Dr. PETTY. That's right.

Dr. HUMES. Laterally to the right and slightly above the external occipital protuberance is a lacerated wound which I describe for your identification. You may wish to go back and look and add some corrections and whatever to this note.

There's another fact of this. Having completed the examination, others might be interested in this—

Dr. BADEN. Yes. We're in session, Joe.

Dr. HUMES. Having completed the examination and remaining to assist the morticians in the preparation of the body, we did not leave the autopsy room until 5:30 or 6 in the morning. It was clearly obvious that a committee could not write the report. I had another commitment for that morning, a little later, a religious commitment with one of my children. And so I went home and took care of that, slept for several hours until about 6 in the evening of the day after, and then sat down and wrote the report that's sitting before you now, myself, my own version of it, without any input other than the discussions that we thought that we had had, Dr. Boswell, Dr. Finck and myself. I then returned that morning and looked at what I had written—now wait, I'm a day ahead of myself—Saturday morning we discussed—

Dr. BOSWELL. Saturday morning we got together and we called Dallas.

Dr. HUMES. We called Dallas. See, we were at a loss because we hadn't appreciated the exit wound in the neck, we had been—I have to go back a little bit. I think for your edification. There were four times as many people in the room



most of the time as there are in this room at this moment, including the physician to the President, the Surgeon General of the Navy, the Commanding Officer of the Naval Medical Center, the Commanding Officer of the Naval Medical School, the Army, Navy, and Air Force aides to the President of the United States at one time or another, the Secret Service, the FBI and countless nondescript people who were unknown to me. Mistake No. 1. So, there was considerable confusion. So we went home. I took care of this obligation that I had. To refresh my mind, we met together around noon on Saturday, 11 in the morning, perhaps 10:30, something like that and—

Dr. BADEN. Now this is the day after?

Dr. HUMES. The day after, within 6 or 8 hours of having completed the examination, assisting Waller's and so forth for the preparation of the President's remains. We got together and discussed our problem. We said we've got to talk to the people in Dallas. We should have talked to them the night before, but there was no way we could get out of the room. You'd have to understand that situation, that hysterical situation that existed. How we kept our wits about us as well as we did is amazing to me. I don't know how we managed to do it as poorly or as well as we did under the circumstances. So I called Dr. Perry. Took me a little while to reach him. We had a very nice conversation on the phone in which he described a missile wound, what he interpreted as a missile wound, in the midline of the neck through which he had created a very quick emergency, as you can see from the photographs, tracheotomy incision. In effect destroying its value to us and obscuring it very gorgeously for us. Well, of course, the minute he said that to me, lights went on, and we said ah, we have some place for our missile to have gone. And then, of course, I asked him, much to my amazement, had he or any other physician in attendance upon the President, examined the back of the patient, his neck, or his shoulder. They said no, the patient had never been moved from his back while they were administering to him. So, the confusion that existed from some of his comments and the comments of other standby people in the emergency room in Dallas had been in the news media and elsewhere, so that added to the confusion. So, following that, and that discussion, and we having a meeting of minds as to generally what was necessary to be accomplished, and being informed by the various people in authority that our gross report should be delivered to the White House physician no later than Sunday evening, the next day, 24 hours later, or not quite 24 hours later. Not having slept for about 48 hours, I went home and rested from noon until 8 or 10 that evening, Saturday evening, and then I sat down in front of other notes on which I had made minor comments, handwritten notes.

I wrote the report which is present here. Now we also have here—and since it's in the record I want to comment about it—some comments that I destroyed, some notes related to this, by burning in the fireplace of my home, and that is true. However, nothing that was destroyed is not present in this write-up. Now, why did I do that? It's interesting, and I've not spoken of this in public. Not too long before this, I had had the experience of serving as an escort officer for some foreign physicians from foreign navies, who were being entertained and given a course of instruction in the United States. We had 20 or 30 of these chaps, and they used to come through every year or two, and I often was escort officer for them. They spent 5 weeks in Washington or 5 weeks in the field, then we went various places. We went to submarine bases and Marine Corps installations and naval training centers to teach them how physicians function in the American Navy. One of the places to which I happened to take them—and we tried to teach them a little Americana—I took them to Greenfield Village, which, as many of you know, Henry Ford set up adjacent to his former home in suburban Detroit, Dearborn. And in that location is a courthouse in which President Lincoln used to hold forth when he was riding the circuit, and these men were very impressed with that, and they knew who President Lincoln was and were impressed with his courthouse and many other things in Greenfield Village. But what I was amazed to find there, because I personally did not know it was there until I made that visit, was the chair in which President Lincoln sat when he was assassinated.

Somehow or other they got that chair out of Ford's Theatre, and Henry Ford got it into Greenfield Village, and it's sitting in this courthouse. Now the back of that chair is stained with a dark substance, and there's much discussion to this day as to whether that stain represents the blood of the deceased



President or whether it is Macassar. I don't know if you all remember what Macassar is. When people our age were young and you'd visit your grandmother, on the back of the sofa there were lovely lace doilies in the homes of many people. And if you recall what I'm speaking of—they were on the sofas and reclining chairs—and those lace doilies bear the name antimacassar. You could go to a store in this country and buy an antimacassar. They don't exist any more. And Macassar was a hair dressing that gentlemen wore in those days to keep their hair in place. And these officers were appalled that the American people would wish to have an object stained with the blood of the President on public display. And I was—it kind of bothered me a little bit—it still does, to this day. And here I was, now in the possession of a number of pieces of paper, some of which unavoidably, and in the confusion which I described to you earlier, were stained in part with the blood of our deceased President. And I knew that I would give the record over to some person or persons in authority, and I felt that these pieces of paper were inappropriate to be turned over to anyone, and it was for that reason and for that reason only, that, having transcribed those notes onto the pieces of paper that are before you, I destroyed those pieces of paper. I think I'd do the same thing tomorrow if I had a similar problem, because I felt they would fall into the hands of some sensation seeker.

Dr. BADEN. Is everything you had on the notes recorded in the holographic document before you, which is kept in the Archives, that you wrote at that time?

Dr. HUMES. Correct. Now, there are corrections and comments and changes of language in here. I think I'd have to go through them and with care to see if some of them are substantive or not substantive, and they are a result of meeting with Dr. Boswell and Dr. Finck on Sunday afternoon in the Naval Medical Center and going over them together. This document then was signed by all three of us, whereas in the part before some minor changes were made—maybe they—some of them sounded like we'd expressed an opinion, and we thought maybe that wasn't what should be done.

But in any event, this document then was signed by all three of us and, parenthetically in the middle of this preparation, other naval officers were not—no one was telling us anything. We did this strictly on our own. But in an adjacent room and awaiting the results of our efforts were other senior naval officers watching the television. And it was at that point, of course, that Mr. Oswald was assassinated or shot, and, in fact, we interrupted our work to try and figure out what that meant to us. So, in any event then, this document was typed up under my immediate supervision by a woman, secretary to the Commanding Officer at the Naval Medical Center, and I personally hand-carried the written document to the office of the White House physician about 6 on Sunday evening.

Dr. ROSE. Could the record reflect that Mr. Oswald's preliminary documents, also at a much later time, Mr. Ruby's documents, the preliminary ones, were similarly taken care of—

Dr. HUMES. I don't wish to apologize because I don't think that an apology is necessary, but I'd like for this document, for the record, to reflect exactly what happened, some place, as it did.

Dr. BOSWELL. As to the previous comment, I have frequently redrawn diagrams that might have gotten a spot of blood on them.

Dr. HUMES. Now, I didn't redraw Jay's, and don't ask me why, because it was, I guess it was because I didn't have another piece of paper and I didn't want to sit down and reproduce a drawing.

Dr. ROSE. Doctor, I apologize for doing it in the case of Mr. Oswald.

Dr. BADEN. Let the record note that the previous speaker, Dr. Rose, did perform the autopsies on Mr. Oswald and Mr. Ruby.

Dr. HUMES. OK. Now, the reason that we were referring to these photographs was some discussion between Dr. Petty and myself as to the verbalized location of the wound, what we interpreted as the wound of entrance, and my problem is that these are, to my recollection, my interpretation of what I saw. The problem that we have now, I think, in the photographs at least in part, may or may not explain the situation totally to everybody's satisfaction. The photographs do not clearly demonstrate where the external occipital protuberance is, and that's the only comment I could make Chuck about that. I feel, by looking at this photograph, that the wound was in fact below the external occipital protuberance and certainly no worse than lateral to it.

Dr. PETTY. Well, we have some interesting information in the form of the photographs of the brain, and if this wound were way low, we would wonder at the intact nature, not only on the cerebellum, but also on the posterior aspects of the occipital lobes, such as are shown in Figure 21. Here the cerebellum is intact, as well as the occipital lobes, and this has concerned us right down the line as to where precisely the inshoot wound was, and this is why we found ourselves in a quandary, and one of the reasons that we very much wanted to have you come down today.

Dr. HUMES. The photographs unfortunately are not three-dimensional, and that's part of the difficulty, I think.

Dr. DAVIS. Early, I was asking Dr. Boswell if he had had an opportunity at some previous time to meet with a group of pathologists such as ourselves. Forensic pathologists, and go over the photographs and all of this material together, to more or less get a consensus. And, correct me if I'm wrong, Dr. Boswell, it is your impression that this opportunity had never been previously afforded to yourself. How about you, Dr. Humes? Have you had this opportunity in the past?

Dr. HUMES. Absolutely not.

Dr. DAVIS. All right, so, basically, this is the first time that the original people who were there at the autopsy and saw things with their own eyes, wrote reports, have ever had an opportunity to sit down and view these pictures in the company of other pathologists. Now, there have been previously other forensic pathologists.

Dr. COE. That's why I asked if Dr. Boswell had a chance to talk with the Clark Commission pathologist.

Dr. BOSWELL. Well, I was here with him merely to identify photographs and X-rays and whatever other material they went over, and I did answer as many questions as I could, but there was no discussion at that time as to their opinions; they formulated those after I was away.

Dr. DAVIS. So basically, then, there has never been any free association of ideas, a jelling of ideas and clarification of small points that might be interpreted differently from one person to another. So this apparently is the first time a group has got together and sat down and hashed over the case as we so frequently do in our everyday practice.

Dr. PETTY. Dr. Boswell, you and I also were talking during the period when the machine was not actively recording, and you said something that interested me tremendously. May I hear from page 4 of the autopsy report. "Situated in the posterior scalp approximately 2.5 centimeters laterally to the right and slightly above the external-occipital protuberance, is a lacerated wound measuring 15 by 6 millimeters, and I believe you said that the 15 millimeter dimension represented, as you described it, tunneling of the bullet, and that's what you mean by tunneling?"

Dr. BOSWELL. Yes.

Dr. BADEN. Now, continuing with that description that Dr. Humes wrote down, this handwritten report that you described, that particular measurement Dr. Petty referred to, is not indicated on the face sheet, whereas the wound in the shoulder is. Referring to the measurement of 2.5 centimeters laterally to the right and slightly above the external occipital protuberance—was that specific measurement present on your other notes that you utilized?

Dr. HUMES. Yes, sir.

Dr. BADEN. So that you did make that directly from notes taken at the time of the autopsy and then transcribed them?

Dr. HUMES. Right.

Dr. BADEN. Dr. Boswell, I think you may have covered this once before relative to the diagram that you made. The notation of the diagram on the front sheet shows an arrow going toward the left by the perforation near the external occipital protuberance. What does the arrow to the left mean?

Dr. BOSWELL. I think it was only meant to indicate "upward," not laterality at all.

Dr. BADEN. Not that it went to the left?

Dr. BOSWELL. Yes, right.

Dr. BADEN. Thank you.

Dr. LOQUVAM. Charles, would it be possible for Dr. Humes and Dr. Boswell to look at that picture executed to show the posterior cranial fossa? And if the two of them could possibly pick out the point of entrance—I know the picture is in poor focus—

K. KLEIN. Dr. Petty, when you locate the proper photographs could you repeat the question again, because I doubt that the machine would have picked it up.



Dr. PETTY. The question is, Could you, Dr. Humes, or Dr. Boswell, either one, from examination of the photograph purported to show the posterior cranial fossa locate the point of inshoot into the skull? Now we're looking at photograph No. 44.

Dr. BADEN. Is there a black and white of that?

Dr. DAVIS. I think there is; but I don't see it here.

Dr. HUMES. There is.

Dr. BOSWELL. Yes. What number is that?

Dr. HUMES. The black and white photograph is No. 17, the color is 44.

Dr. PETTY. Well, that not the one, I'm sorry. That's the exit wound. I want the one in the posterior cranial—could this be the one that you said earlier was looking down the posterior cranial fossa on the inside?

Dr. HUMES. That's the one right there.

K. KLEIN. And that's No. 45.

Dr. PETTY. Now, could you two possibly, thinking back 16 years, I know how difficult it is, but is there any way that you could show us where the entrance was in that wound?

Dr. BOSWELL. I don't believe it's depicted in that picture.

Dr. HUMES. How about here, Jay?

Dr. BOSWELL. Well, I don't believe so, because, as I recall, the bone was intact at that point. There was a shelf and then a little hole, came up on the side and then one of the smaller of the two fragments in that X-ray, when that arrived, we were able to fit that down there and complete the circumference of that bone wound.

Dr. HUMES. I don't remember that in that detail and I suspect—you see the background, there seems to be blue, with a blue towel placed beneath the head of the President, and I think that may be the wound right there.

Dr. PETTY. Can you orient this for us, Dr. Humes? I am a little confused on exactly—now is this picture oriented like that, or is it like this? Because if this is checked, this has to be posterior dorsal, so the wound has got to be somewhere where Dr. Humes has pointed, because the—

Dr. HUMES. But why would we go to the trouble of putting the ruler there, you see. This is reflected scalp.

Dr. PETTY. I think the biggest point in consideration here is that this is in focus here [pointing to upper scalp area in question] and this is not in focus here [pointing to lower area].

Dr. HUMES. Right.

Dr. PETTY. Therefore we must be looking specifically in that area.

Dr. DAVIS. Did the person who took the photographs ask you what to take or just took what he thought was—

Dr. HUMES. No. no. He was directed.

Dr. BOSWELL. He was taking specific areas.

Dr. HUMES. A real problem.

Dr. BOSWELL. Yeah, I know.

Dr. HUMES. I don't think the photograph permits us to say with accuracy where it is. And recall again that we were not privileged to see these photographs until the date on the legend that comes with it, sometime in 1966.

Dr. BOSWELL. Three years.

Dr. PETTY. But the point of entry on the external surface of the body of the head is incidentally depicted in photograph 15 and shows near the margin of the photograph down toward the hairline of the President. And again here on No. 43 it shows the same thing.

Dr. HUMES. I object to your word "incidentally."

Dr. PETTY. Well, by that I mean it's not the subject of the center of the photographer's lens, it's way down toward—

Dr. HUMES. No, no. But you'd have greater difficulty localizing it, I submit to you, were it the same subject of the photographer's lens.

Dr. BADEN. That's true.

Dr. PETTY. I can understand that, sure.

Dr. BADEN. One of the considerations I had in looking at the film, Dr. Humes, relative to the interpretation I had, was that perhaps you were holding—

Dr. HUMES. Holding the scalp up, holding the head up.

Dr. BADEN. Holding the scalp and head up specifically so that the photographer could get that point.

Dr. HUMES. Not that point. That is not the case.

Dr. BADEN. That is not the case?



Dr. HUMES. Because I submit to you that, despite the fact that this upper point that has been the source of some discussion here this afternoon is excessively obvious in the color photograph, I almost defy you to find it in that magnification in the black and white.

Dr. BADEN. We're not trying to be argumentative. What we're trying to do is fully understand what you say and what you did.

Dr. HUMES. Nor I. Right. The gentleman was in the dorsal recumbent position on an autopsy table, not the greatest photographic position in the world, and we had to hold his head up. One of us is lifting the head, flexing the neck if you will, by holding the scalp, and to show the wound where it was in relation to the man's head.

Dr. BADEN. In reviewing this material earlier today, you made an ink notation on the skull that we have here, localizing the entrance perforation to the right of the external occipital protuberance—in reviewing the skull and marking at this time and having reviewing all of the films and incorporating our discussion, is that still a valid representation?

Dr. HUMES. Yes, I think so.

Dr. BADEN. Dr. Humes, this refers to the notation made on the skull. We are using it as an exhibit, and it is signed and initialed by you.

Dr. HUMES. I believe that that's a reasonable representation. I think that we were making an attempt, and, of course, we didn't have Polaroid in those days, like we might use now, to be sure that we had an image of what we wished, and its interesting how technology changes things. We were attempting in that photograph to demonstrate that wound, and I feel that we have failed to demonstrate the wound.

Dr. BADEN. Would it be fair to ask you Dr. Humes, if in the confusion that was put upon you, as you described earlier in doing the autopsy and taking photographs, it is mentioned in somebody's notes that at one point you had asked who was in charge in the autopsy room—whether that all has significance as to the extent of the autopsy. It has been interpreted that you were under certain directions prior to starting the autopsy.

Dr. HUMES. That was anecdotal. When we were informed that the President was going to be brought for an examination I put on a scrub suit and went to the vicinity of the morgue to await the arrival of the people accompanying the body. By this time, of course, it had become generally known, because when I left to come to the hospital I had no idea why I was even going over there, but by the time I speak of, it was on public radio and television, and crowds of people were gathering around the building in the vicinity of the loading dock adjacent to the autopsy room. There were beginning to arrive large numbers of people. And as I came out of the morgue in my scrub suit before the President's body arrived, there was a photographer, a press photographer roving around the corridors, and I didn't want to get in a personal altercation with him, so I walked out onto the loading dock where there was quite an accumulation of people, and I said, who's in charge here, and I meant of the crowd control as it were. And a gentleman standing no more than 3 yards from me informed me in a very loud voice that he was in charge. And I said who are you. And he said that he was the commanding general of the military district of Washington. I said fine, there's a photographer in there, and I don't think we'd like to have him present. And he dispatched, I think, a Marine captain to come and remove this person. I had no further conversation with this gentleman, nor did he direct me as to what I should or shouldn't do.

Dr. BADEN. All right. During the course of the autopsy, and this has been a point that has been raised before. Did you feel directly or indirectly that somebody else advised you as to what the extent of the autopsy should be. Perhaps as far as leaving marks on the body, or making incisions, or as Dr. Petty brought up in the beginning, whether to look at the adrenal glands or not?

Dr. HUMES. Yes. There was no question but we were being urged to expedite this examination as quickly as possible, that members of the President's family were in the building, that they had refused to leave the premises until the President's body was ready to be moved; and similar remarks of that vein, which we made every effort to put aside and approach this investigation in as scientific manner as we could. But did it harass us and cause difficulty, of course it did how could it not?

Dr. BOSWELL. I don't think it interfered with the manner in which we did the autopsy.

Dr. HUMES. I don't either.

Dr. BADEN. I ask you this question in a sense that all of us here have been in similar positions of a lesser magnitude, when for one reason or another, the family doesn't want an autopsy, a full autopsy or whatever, so we appreciate the situation.

Dr. HUMES. It was stress. The main purpose of the examination, and of course the main purpose that we understood of the examination, was what happened to the President, what killed the President of the United States.

Dr. BADEN. Would you feel that you established—

Dr. HUMES. We established.

Dr. BADEN. Now, for example, not exploring the wound from the back to the neck, that was not done, I mean, cutting it open completely, that wasn't done specifically. Was that because somebody said don't do it?

Dr. HUMES. Now wait a minute, that wound was excised.

Dr. BADEN. The back wound?

Dr. HUMES. Yes, sir. The back of the neck, and there are microscopic slides of that wound.

Dr. BADEN. I see. The skin was taken out. And then was it—

Dr. HUMES. It was probed.

Dr. BADEN. Was it opened up?

Dr. HUMES. It was not laid open.

Dr. BADEN. Now, that was your decision as opposed to somebody else's decision?

Dr. HUMES. Yes, it was mine.

Dr. BADEN. With everything else going on at the time?

Dr. HUMES. Yes. Our collective decisions, I suppose.

Dr. BOSWELL. We had exhibited the midportion of the track and the chest by that time, and demonstrated the contusion on the apex of the lung and subpleurally, and we had at that point two points of the wound and then subsequently the wound of exit.

Dr. HUMES. Pretty good course.

Dr. BADEN. The track definitely did not go through the pulmonary tissue?

Dr. HUMES. Negative.

Dr. BOSWELL. No.

Dr. HUMES. There was a contusion of the dome of the right side of the thorax and a contusion, as Dr. Boswell said, a retropleural contusion, and it was a contusion of the upper lobe of the lung.

Dr. BADEN. Retroparietal pleura. Now, you bring up another issue in which you can be of great help to us, because you say the microscopic slides. We apparently, it appears, will not be able to see the microscopic slides. Certainly at this time they are not available to us. Is there anything you can tell us about the microscopic evaluation and examination?

Dr. HUMES. I can't think of anything that would materially change anybody's opinion. The wound was similar to other bullet wounds that I have seen in the skin, sort of a charring effect of the margins and nothing particularly remarkable.

Dr. BOSWELL. No particulate matter.

Dr. PETTY. Do you know whether there was foreign material or—

Dr. BOSWELL. I don't remember.

Dr. BADEN. Would looking at your microscopic description refresh your memory?

Dr. BOSWELL. Sure.

K. KLEIN. Could we perhaps take 5 minutes and change the tape and the doctor's can look at their descriptions?

Dr. BADEN. Starting the record again at this point with a new tape, Dr. Humes and Dr. Boswell were about to refer to the microscopic findings that they noted.

Dr. HUMES. Yes. We were asked specifically about the skin wounds and was there any foreign particulate material in either of the skin wounds, and we refreshed our minds by looking at the brief microscopic report we made, and described in that sections of both the occipital and upper right thoracic wounds that were examined. They were essentially similar, and the only foreign material described were several bone fragments at the margins of the wound and the scalp, so we did not describe foreign particulate material, and I therefore presume it was not present.

Dr. PETTY. Earl, did you have any questions or comments?



Dr. ROSE. No.

Dr. PETTY. John?

Dr. BADEN. Is there anything that perhaps we haven't covered that might be of pertinence to the group?

Dr. HUME. No, I'm distressed with the confusion and allegations of complicity in some plot that we may have been engaged in, which of course is totally ridiculous. We operated under great difficulty. We operated under difficulty in testifying before the Warren Commission, because at that juncture we had not photographs or the X-rays available to us. We worked with an artist, a young medical illustrator who worked for us at the Naval Medical School, and he made a couple of schematic diagrams which have been widely publicized and came reasonably close to describing what our interpretation was of the path of the missiles that struck the President. If you want to try and dissect those in great detail, you'd have to recall that we were doing it from memory and he was doing it thirdhanded, at very best, and he was quite a young person and quite capable, I think, for his years and his experience. He did a pretty good job. Our interview with the Warren Commission, however—I think it's detailed, I'm sure, in the volumes—was reasonably exhaustive, and we had no difficulty with questions that were asked and really have not had any official contact with anybody else officially reviewing this material in the intervening years. From our point of view and that of any pathologist who is saddled with this kind of a responsibility, the peripheral things as to whence cometh the missile and where it went and various other things and so-called single-bullet theory has been, in part, attributed to us, and that's not of our doing. Our descriptions are of the anatomic abnormalities that we found. It did not seem inconsistent to us if this bullet exited the anterior neck of the President, it had to go somewhere, and the person who was sitting in front of him was the Governor, and if it didn't hit him, I for the world have no idea where it went. Those kinds of things are peripheral, but we've been sort of involved, or our names have been involved, with those kinds of conjectures that we really can't make any definite opinion about or scientific opinion about.

Dr. BADEN. But in essence you said, as you indicated before, your main goal at the time you did the autopsy was to determine what happened to the President, and the bottom line for you then, as it is now, having reviewed everything and discussed everything, essentially two gunshot wounds from behind struck the President.

Dr. HUMES. Correct.

Dr. BADEN. Now, there may be, as we're going over the photographs and X-rays and all, some room for discussion about precise points, but you feel the essential findings are two gunshot wounds from behind and from above, I take it, or just from behind?

Dr. HUMES. I think behind is probably the most one can say from the anatomic findings.

Dr. BADEN. And, apart from the tremendous pressures—nonspecific pressures—to get the things done rapidly, you didn't feel any specific pressure—knowing what the request of the families are in situations like this—to be as quick and brief as possible. You didn't perceive any specific constraint on you by an individual as to what you should or shouldn't do as far as the autopsy goes?

Dr. HUMES. Not as it pertains to the injuries to the President.

Dr. BADEN. Well, as pertaining to the whole autopsy. This is one of the things I'm concerned with in viewing the autopsy protocol. There are many organs in addition to the adrenal glands, that you don't specifically describe. Was that of your own judgment and temperament and emotion, or, more specifically, possibly from another source?

Dr. BOSWELL. There were no constraints. Initially Admiral Burkley said that they had caught Oswald and that they needed the bullet to complete the case, and we were told initially that's what we should do, is to find the bullet. Following the X-rays we realized that that was not possible, that there was no bullet there, except fragments, and at that point, Jim and Admiral Burkley discussed it, and it was at that point that he agreed that we should continue and do a complete autopsy, which we then did.

Dr. HUMES. Right.

Dr. BOSWELL. And that was the only constraint during the course of the autopsy, and that was immaterial as it turned out.



Dr. BADEN. I think it would be derelict for us not to afford you an opportunity to answer these questions, since this is the first discussion you're having among peers—

Dr. HUMES. No. It would be a mistake, it would be a mistake for anybody to interpret that any of this confusion under which we operated significantly interfered with our ability to make this examination, to take these photographs, to do the X-rays and so forth; no. Through the gigantic retrospectoscope, would one do everything exactly today as one did that evening, that's another question.

Dr. BADEN. But you did at some point consult with Admiral Burkley as to how far to go?

Dr. HUMES. Well, early on. His desire was, he's a physician, he's a family physician, he was the family physician to the President's family, his concerns were, I think, very understandable in light of the emotional attitude of the family. He was in hopes that the examination could achieve its goal in as expedient a manner as possible, which I think reasonably and accurately describes what he was—

Dr. PETTY. Does anybody have any other questions? I think we ought to, for the record, poll everyone.

Dr. BADEN. Yes. As we go around, this is the only opportunity Dr. Boswell and Dr. Humes have had to discuss this thing further, and we should make sure that there aren't any thoughts or issues that anyone has concerned that, in fairness to everybody concerned, haven't been discussed or have been left unclear. Dr. Earl Rose.

Dr. ROSE. No questions. Thank you very much.

Dr. BADEN. John Coe?

Dr. COE. No further questions. I'd also like to thank Dr. Humes and Dr. Boswell for appearing before us today.

Dr. BADEN. Dr. George Loquvam?

Dr. LOQUVAM. No questions except my sincere thanks to these two gentlemen.

Dr. BADEN. Dr. Davis?

Dr. DAVIS. No questions, but I again would like to thank them very much because I think that this has helped us and will probably help set the record straight in clarifying the issues that have been raised.

Dr. HUMES. I would at this juncture, if I might, interject one thing. It was reasonably easy to demonstrate, certainly verbally, if we didn't succeed in photographs, the wound of entrance in the posterior portion of the skull. It was not so easy to accurately locate the wound of exit because of the great disruption of the fragments and loss of tissue and bone in that area, so that we placed it a little behind or a little below or a little wherever in relation to what now we collectively may decide, after looking in a dispassionate, quiet manner, with X-rays and photographs and things that are available. I'm not a bit surprised, because X-rays No. 1 and No. 2 show you the massive defect, and it is kind of hard to pinpoint it in that massive defect. And these flaps were not firmly attached, they were bony fragments, floating around in the loose scalp.

Dr. PETTY. I have no further questions, but I think that we would have been remiss if we had not invited you to come down and give us a hand in trying to interpret the photographs. I think that any inquiry into photography, X-rays, and so forth ought to be accompanied with an on the level discussion between the people that were involved at the time and with the people that are reviewing, and I think this is just great to be able to establish some form of rapport which has been denied you, I might add, for some little time.

Dr. HUMES. Well, I would again comment for the record that we have acceded to any reasonable request from any responsible persons in this regard and have shunned any other types of discussion about this case. Well, I've gotten to know John Lattimer for other reasons. I know some of the things he's done, and I have had conversations with him. He's come and lectured and given a talk at our hospital, things of that nature, but as far as engaging in any other type of discussion, as you very well know Dr. Petty, we have not nor do we plan any such discussions we feel are inappropriate.

Dr. BADEN. Given this opportunity for all of us, is there anything further Dr. Humes or Dr. Boswell that you perhaps want to get into the record or that could be of assistance that we've left out? When 6 years from now we say, well, why didn't we discuss this or that, the record should be clear that you've been under our questioning now for 2 hours and 20 minutes.

Dr. HUMES. We're in no hurry, as I told Dr. Petty earlier, anything that would come up in the future after we leave that we can be helpful with, I would hope that you would provide us the opportunity to be of assistance.

Dr. BADEN. Dr. Boswell, anything?

Dr. BOSWELL. Nothing.

Dr. BADEN. One minor thing. Looking at the X-rays, there seem to be three of them that were taken after the body was eviscerated.

Dr. BADEN. Do you recall whether you took most of the X-rays prior to the autopsy?

Dr. HUMES. I can clarify that, because having not found a missile of any substance and having had experience in other locations, as anybody has, that bullets can do very strange things, we decided that we should take total X-rays of this gentleman to be certain that some bullet didn't travel down an extremity or go some other place. And it was at that juncture that we made the decision, because we've all had that disturbing experience to have a missile do some very strange things, so we probably had eviscerated the body before we took X-rays of the extremities for instance——

Dr. BADEN. Additional X-rays?

Dr. HUMES. Yes, whatever.

Dr. BADEN. I also want to thank you both tremendously, not only for being of help, but of being of instant help on such short notice.

K. KLEIN. And, finally, on behalf of the staff I also want to thank you both very, very much for coming down here.

[Note: The following was not transcribed.]

Dr. BADEN. I definitely did ask Dr. Humes, following the transcription, whether any other post mortem X-rays were taken that he is aware of, other than those we showed him in possession of the Archives. He said definitely not, that these were the same X-rays of the President as he first saw them, and that he did not have X-rays taken of the peripheral part of the extremities, including the hands and feet.

Kennedy

005003

INVESTIGATION INTERVIEW SCHEDULE1. Identifying Information:

Name Dr. C. James Carrico Date Jan 11, 1978  
 Address Harbor View Medical Center Place Harbor View Medical Center  
 City/State Seattle, Wash Telephone \_\_\_\_\_  
 Date of Birth \_\_\_\_\_ M or S \_\_\_\_\_  
 Social Security \_\_\_\_\_ Spouse \_\_\_\_\_  
 Children \_\_\_\_\_

2. Physical Description:

Height \_\_\_\_\_ Color Eyes \_\_\_\_\_ Hair \_\_\_\_\_  
 Weight \_\_\_\_\_ Special Characteristics \_\_\_\_\_  
 Ethnic Group \_\_\_\_\_

3. Personal History:

- a. Present Employment: \_\_\_\_\_  
 Address \_\_\_\_\_  
 Telephone \_\_\_\_\_
- b. Criminal Record  
 1. Arrests \_\_\_\_\_  
 2. Convictions \_\_\_\_\_

4. Additional Personal Information:

- a. Relative(s): Name \_\_\_\_\_  
 Address \_\_\_\_\_

b. Area frequented: \_\_\_\_\_

c. Remarks: \_\_\_\_\_

Investigator Andy Purdy and Mark Flanagan

Date January 23, 1978

Form #4-B



DATE: January 11, 1978

TIME: 2:55 p.m.

PLACE: Seattle, Washington  
Harbor View Medical Center

STAFF PRESENT: Andy Purdy, Staff Counsel  
Mark Flanagan, Staff Researcher

INTERVIEWEE: Dr. James Carrico

KEY: C - Dr. Carrico

P - Purdy/Flanagan

- P: Dr. Carrico, we have just been discussing the events of November 22, 1963, and your treatment of President Kennedy and in some detail, the nature of the wounds for approximately the last hour. Is that correct?
- C: That's correct.
- P: For the record, could you please state what your present position is.
- C: I'm Professor of Surgery at the University of Washington and Surgeon Chief at Harbor View Medical Center which is one of the University of Washington teaching hospitals.
- P: How much experience in treating gunshot have you had since 1963?
- C: One of my interests has remained the management of trauma and I would estimate I've seen roughly 60 to 75 gunshot wounds a year since that time.
- P: Could you please describe the condition of President Kennedy when you first saw him in the Trauma Room at Parkland Hospital and begin in some detail, a description of those wounds and the work you performed.

C: When I first saw him, he could best be described as agonal, his color was ashen blue-gray, respiration, he did have spontaneous respirations, they were irregular, spasmodic and not very effective. The nurse reported that he didn't have a blood pressure. I listened to his chest very briefly. He had some irregular sounds which I interpreted as heart sounds. There was some urgency to establish that he had two obvious wounds, one in the anterior neck, just to the right of the trachea just below the larynx. From that wound was issuing foamy blood, mostly air, some blood with each attempt at respiration. The other wound was a fairly large wound in the right side of the head, in the parietal, occipital area. One could see blood and brains, both cerebellum and cerebrum fragments in that wound. The area was the most urgent item and I successfully passed an oral, endotracheal tube by mouth. I noticed at that time probably some deviation of the trachea to the left, very slight, some modest amount of hematoma in the recesses to the right of the trachea. The endotracheal tube was passed, the balloon was inflated, and we were able to then maintain adequate ventilation, although there was still some leak around the hole in the anterior neck. By that time, several other physicians had arrived, and I directed my attention to establishing more and intravenous fluids, administration of fluids and medications while they continued to work on the .

I

- P: Upon your first examination of the anterior neck wound, was there any material going in or out of that wound?
- C: Air. You could tell there was air going in and out because the foamy material was issuing back and forth and you/hear <sup>could</sup> the air going in and out.
- P: Could you describe this movement of material as a bubbling effect -- what did that material consist of?
- C: Mostly air bubbles of foamy blood.
- P: In describing the foam that you saw when you placed the endo-tracheal tube, where was that foam coming from? Was it coming from between the vocal cords?
- C: Yes it/coming up - there was some foam between his cords and <sup>was</sup> a little bit of air coming out.
- P: Could you describe as best you can how the wound in the anterior neck looked?
- C: My total recollection of that wound was of a small, fairly circular wound, with material issuing from it. And that's really my total recollection.
- P: Based on your examination of that wound, are you able to tell us anything about the direction in which whatever object caused the wound had been passing? Were you able to determine what the nature of the object had been which had caused the wound?
- C: Not for sure.



J

P: What was your belief?

C: It looked like a bullet.

P: Was it your sense that it was a full bullet or a bullet fragment?

C: I would have no idea.

P: Was it your impression that the bullet that you felt had caused the wound had been traveling straight, was there a slight tumble, or was there a significant tumble to that bullet?

C: It's unlikely that there was any significant tumbling action because that would usually result in a larger wound, if that were in fact an exit. If it were an entrance wound / <sup>anyone</sup> could make no conclusions.

P: Based on your view of the wound, are you able to tell us anything about the angle through which the object passed through the President?

C: Not from my view, alone.

P: From what evidence are you able to make what determination about the angle?  
Only that

C: /There was some injury to the trachea behind it, so the thing must have been going front to back, rather than right to left. That's about all you could say.

P: And you said you weren't able to make a determination about the angle, so presumably that means you were not able to say that it was from lower to higher or from higher to lower?

C: That's correct. I couldn't make any guesses about that.

- P: Before the Warren Commission, you were asked a question which detailed a number of characteristics of damage through the President's body of a missile. I'd like to explore that hypothetical to see which of this evidence, if any, you know from personal knowledge and what you may know from other sources. You were told to assume that the missile passed through the body of the President, striking no bones, traversing the neck and sliding between the large muscles in the posterior aspect of the President's body through a fascial channel without violating the pleural cavity. Based on the evidence as you knew it, did you have independent knowledge of this fact ?
- C: No.
- P: I'll continue. But bruising only the apex of the right pleural cavity. Did you have independent evidence that the apex of the right pleural cavity was damaged?
- C: No... at this point, we're beginning to get into an area where I could at least have some knowledge that was compatible with that.
- P: What knowledge would that be?
- C: That we saw the bruising, the hematoma beside the trachea. But I still didn't know whether the pleural was bruised or not.
- P: Could the pleural have been bruised?
- C: Yes, certainly.

- P: I'll continue: But bruising only the apex of the right plural cavity and bruising the most aevical portion of the right lung. Did you have independent knowledge that the most aevical portion of the right lung was bruised?
- C: No
- P: Did you have any other evidence which would indicate that it might be or that it was likely that it was?
- C: Again, that hematoma was in the area would be compatible with that, but certainly wouldn't indicate any lung injury.
- P: And continuing: then causing a hematoma to the right of the larynx, which you described. As you said before the Warren Commission, I'll ask you now, was the appearance of the wound in the anterior neck consistent with those facts?
- C: Yes, certainly it's consistent.
- P: Could you please continue with <sup>a</sup>/description of the treatment of the President after the insertion of the endotracheal tube.
- C: After the endotracheal tube was inserted, as I said, the next step is to try to restore breathing -- an airway, then you try to restore the circulation. And we had adequate but not perfect ventilation. The next thing we tried to do was get the circulation going. There were already a couple of IV lines started by incisions in the ankle. Another one was being done in the arm. The President was getting fluids through those to try to get his blood pressure up. I don't know if blood had been started at that point or not. He was given some <sup>carto</sup>/steroids, and Dr. Perry<sup>and Dr.</sup>/Jones took over the primary management and I started



making sure that the IVs, etc. were running properly.

P: They were dealing with the primary management of what portion?

C: They were calling the shots. They were <sup>overall</sup> /quarterbacking of his care, which basically consisted of trying to get vital signs, vital functions going, breathing going, circulation going, and assess how bad his head injury was.

P: What was your primary emphasis at that time. Would it be fair to say that you moved on from consideration of the airway problem to one of the circulation?

C: Yes.

P: What happened then in regard to the airway problem? What did Dr Jones and Dr Perry do?

C: The ventilation appeared to be adequate, we could not get adequate circulation. Their concern was that conceivably there was either, because there was still leakage around the trachea, that either the tube was not functioning entirely properly, or that there was some pneumothorax, some pleural injury. So they performed a tracheostomy to assure an adequate airway and instructed some other physicians to insert chest tubes to try to rule out the possibility of any tension in the thorax which could impair his circulation also.

P: What evidence did you obtain from the chest tubes?

C: Again, this is second-hand, I didn't do this. But, when the chest tubes were inserted, there was a small amount of blood,

and small amount of air, which could have resulted from the actual surgical manipulations or could conceivably have been commensurate or compatible with some very small pneumothorax or hemothorax. But / <sup>basically</sup> the chest tubes did not show any signs of massive injury and did not in their insertion didn't improve the situation.

P: Did you have sufficient facts from which you could conclude that the pleural cavity was violated?

C: No, we did not.

P: Did you believe it was likely that the pleural cavity was violated?

C: We felt there was a high risk that it had been. After the chest tubes were inserted, we were sure that it was no longer potentially harmful to his life. But we still didn't know for sure whether it had been violated or not.

P: Do you have an opinion as to why there was leakage from the wound?

C: After the tube was inserted? I really don't. There are two fairly good possibilities. One is that the balloon was not completely through his trachea, either because it was not down quite far enough, or it was not blown up quite enough. Those are the two possibilities that would be most likely.

P: Why was <sup>Kennedy</sup> President/given steroids?

C: Because we had, there had been an argument in the local papers a few weeks previously that raised the question of whether or

not he had adrenal insufficiency. If one does have adrenal insufficiency and is injured, then you need extra steroids.

P: If there any risk to giving the person extra steroids if they don't need it?

C: Very little. Virtually none. Matter of fact, the amount he was given is the amount that your or my adrenals would excrete in time of maximum stress.

P: How harmful would it be for a person with an adrenal insufficiency not to get steroids at a time like this?

C: Nobody really knows. The current medical opinion is that you need that adrenal support to respond to the stress. And without that kind of support, one could go into shock. If one really wants to get esoteric, you can argue about whether that's really true or not. But in general, the current medical practice would be to give them. And if one were going to do an operation on someone with adrenal insufficiency, you would give steroids prior to enduring the operation.

P: Did Dr. Berkeley give you any advice as to whether or not steroids should be given?

C: Sometime during the course of resuscitation, and I've honestly forgotten how far along, he came in, asked if the President had steroids or not, I answered something like "I've forgotten what. He handed me some vials and said, "give him these."



- P: Did you give him those?
- C: I handed those to the nurse, and said "go ahead and give them."
- P: Did Dr. Berkeley say that President Kennedy was an Addisonian?
- C: I don't recall him saying that. He just asked if he'd <sup>them or not</sup> had / and I answered in the affirmative.
- P: Do you remember any discussion about whether he was an Addisonian?
- C: I really did not hear any other discussion.
- P: Did you witness the tracheostomy incision?
- C: No, not directly.
- P: Do you know why the tracheostomy incision was made?
- C: Basically because there was concern that the ventilation through the endotracheal tube was conceivably not adequate. It was leaking and he wasn't doing well.
- P: Did the procedure giving the tracheostomy incision give you a further look at the nature of the anterior neck wound of the President.
- C: It did not give me any further look. I was not involved.
- P: Did you see the anterior neck area subsequent to the tracheostomy incision?
- C: No, I did not.

- P: After the tube would be put into the tracheostomy incision, to what extent, if any, would a wound, or could a wound in that area be obscured?
- C: Because of the nature of most tracheostomy tubes, the incision would almost totally be obscured. There is a flange over, near the mouth of the treacheostomy tube that covers most treacheostomy incisions.
- P: Is it your recollection that this tube in question had such a feature?
- C: I would almost be sure it did. That's from memory of tubes more than that specific technique used.
- P: Did you have any evidence which would indicate that one of the President's transverse processes was fractured?
- C: No, I didn't.
- P: Did you have any evidence which would indicate that it was unlikely that this was the case?
- C: No.
- P: Would a fracture of the transverse process be inconsistent with a bullet exiting through the front of the neck as you've described the nature of the wound?
- C: I don't think so. It's unlikely that a missile would have gone through the body of a transverse process and not have lost more energy than this thing apparently lost. But it certainly could have chipped one or nicked it or something like that, and not have made much difference.

- P: Could you briefly describe for us the nature of the wound in the President's head?
- C: The head wound was a much larger wound than the neck wound. It was five by seven centimeters, something like that, 2½ by 3 inches, ragged, had blood and hair all around it, located in the part of the parietal occipital region, .
- P: Could you just state in layman's terms the approximate place that would be.
- C: That would be above and posterior to the ear, almost from the crown of the head, there was brain tissue showing through.
- P: Would the neck wound, by itself, have been fatal?
- C: No, I do not think so. I think that was a recoverable wound.
- P: You think it was unlikely that it would have been fatal. Would the neck wound have permanently impaired the President's speech?
- C: I don't believe so.
- P: Would it have impaired the President's speech so that he could not have spoken in the Presidential limousine just after he was injured?
- C: It would have made it difficult. There would have been an air leak from the trachea and it would have been difficult for him to speak in a natural fashion, with great effort he might have formed some words.



P: As one of the attending physicians, were you, was it inconsistent with normal procedure that you were not contacted by the autopsy surgeons?

C: Not really, because I was fairly far down <sup>the</sup> ladder, in being a resident. Dr Perry was above me, Dr Jones was above me. Had the autopsy been done by the forensic pathologist in Dallas, he would almost have certainly have consulted one of the attending physicians. When autopsies were done elsewhere, <sup>like you say</sup> we ordinarily had requests for that, / what was routine.

P: Did you or any of the other doctors consider initiating a contact with the autopsy surgeons about what you had seen and done?

C: I did not. I don't know if any of the other doctors did or not. We did write our handwritten notes which we assumed would be transmitted with the President, either to the forensic pathologist there or wherever. And, as I think of it, I'm not sure we were aware until some time later that they had not been.

P: Were you surprised that none of the attending physicians were in communication with the autopsy surgeons prior to the completion of the autopsy?

C: I don't guess surprised is the word. As I think back, trying to remember, I guess we assumed

(tape running while interview interrupted)

- C: You asked me, was I surprised that the autopsy were not in communication with any of the attending physicians. As I say, I guess, I remember we assumed those written documents had gone to whoever was doing the autopsy, and had it been done by Dr. Rose. I think he would have contacted somebody. So I guess the best thing to say is that there was certainly limited information available to the guy who <sup>I</sup> did the autopsy, and/think in general there would have been some contact, had the geography been a little closer.
- P: Do you have any additional comments or points that you feel have been misstated in the record or you feel that should be cleared up, that you'd like to comment on at this time?
- C: I don't believe so.
- P: Do you have anything else you'd like to add to your descriptions of the wounds as you described them for this tape?
- C: Only the fact that the thing we talked about earlier is that there's a big difference in what you look for for patient care and for forensics, and that we were looking for patient care. And you basically see what you look for, and we were not looking to try to determine whether this was an entrance or exit wound, anymore than we needed to know to try to determine what the life threatening complications or results of that injury might have been. So we didn't look to see where the missile came from, what it's direction was, whether it was an exit wound or not.
- P: This taping session is now over. Time is 3:20.

OUTSIDE CONTACT REPORT

F-34

DATE 2/27/78 TIME \_\_\_\_\_I. Identifying Information:Name Dr. Norman Chase Telephone \_\_\_\_\_Address NYU Medical Center, New YorkType of Contact: Telephone  
X PersonII. Summary of Contact:

Dr. Chase examined the JFK and Connally X-rays in the pre-  
sence of Dr. Michael Baden, Mark Flanagan, and Andy Purdy.

He made preliminary observations before we focussed his atten-  
tion on particular areas of interest to the medical panel.

JFK: Skull X-ray - The lateral skull X-ray indicated that  
the missile "...blew the top of the head off. . .striking  
with enormous power." The wound was massive, not the kind  
he would expect from a single, jacketed bullet hitting straight  
on; it was possibly tumbling or hit on an angle. The entry  
point was visible on the upper rear head. Regarding the  
anterior-posterior X-ray, Dr. Chase noted the large metal  
fragment prominent in the X-ray and said he believes it cor-  
responds to the metal fragment in the rear of the head as evi-

III. Recommended Follow-up (if any):

Signature: \_\_\_\_\_

Andy PurdyMark Flanagan

Form #1



dence on the lateral view. He said the frontal fragment would appear higher (than the aforementioned fragment) in the anterior view (and slightly left of center).

Dr. Chase said the head X-rays show extensive comminuted fractures of the calvarium. He said that while it is unclear exactly what happened to the top of the skull because of the extensive damage, he is sure that the skull was not perforated by a missile at any point below the one he designated as an entrance wound. When referred by Dr. Baden to the lower skull region and asked what his response would be if told that the autopsy surgeons believed there was a wound of entry there, he said he would say they were wrong.

He said the degree of damage to the skull and the fact that there was "little residual material" led him to believe the missile was jacketed. He said there is no evidence in the X-rays of a shot coming from the front or of more than one bullet striking the skull; for there to have been a second bullet, Dr. Chase said there would have to be another exit point in the skull or a bullet which was left behind (which entered the exit hole of the one bullet which entered in the upper rear of the head).

Regarding the circular temporal bone area, Chase said it appeared to represent normal skull thinning at that point but said there could be bone missing, noting the area was "...awfully luscent." When viewing a pre-assassination lateral skull X-ray, Dr. Chase said he believed there was

exit of bone from the temporal area, the zygomatic process (lateral view). He also noted fracture of the right orbit.

In the neck X-ray, Chase noted the presence of a metal fragment or artifact in the area of the transverse process--definitely not a bone fragment. The first rib appeared to be separated from the sternum but he had trouble noting specific evidence of a missile passing through the first or second rib. Air was noted in the subcutaneous tissue in this same region, caused by the passage of a missile and/or air entering the region due to the tracheostomy incision. He said the object present was not bone because it was too small and too dense; the little trail of dots near the fragment were believed to be artifacts. The object was about 1 mm x 2½mm--"very small." Chase said that if a break occurred in T-1 it was peculiar and had no displacement. He said that extra work on X-ray #9 might bring out this fragment in another view.

CONNALLY: Regarding the thigh X-ray, Chase said there was a metal fragment in the subcutaneous tissue and there was no fragment in the femur; the object thought to be such a fragment is artifact.

Regarding the chest X-ray, he said there was no evidence of pneumothorax. The fifth rib appears fractured in the post-operative X-ray but is not evident in the pre-op

(region of posterior axillary line or mid-axillary line). Soft tissue damage is evidenced by the presence of air and blood.

Dr. Chase had no recommendations for experts in forensic radiology.



*Kennedy*INVESTIGATION INTERVIEW SCHEDULE

003974

Identifying Information:

Name Dr. Marion T. Jenkins Date 11/10/77  
 Address Parkland Hospital Place Parkland Memorial Hospital  
 City/State Dallas, Texas Telephone \_\_\_\_\_  
 Date of Birth \_\_\_\_\_ M or S \_\_\_\_\_  
 Social Security \_\_\_\_\_ Spouse \_\_\_\_\_  
 Children \_\_\_\_\_

Physical Description:

Height \_\_\_\_\_ Color Eyes \_\_\_\_\_ Hair \_\_\_\_\_  
 Weight \_\_\_\_\_ Special Characteristics \_\_\_\_\_  
 Ethnic Group \_\_\_\_\_

Personal History:

- a. Present Employment: \_\_\_\_\_  
 Address \_\_\_\_\_  
 Telephone \_\_\_\_\_
- b. Criminal Record  
 1. Arrests \_\_\_\_\_  
 2. Convictions \_\_\_\_\_

Additional Personal Information:

- a. Relative(s): Name \_\_\_\_\_  
 Address \_\_\_\_\_  
 \_\_\_\_\_
- b. Area frequented: \_\_\_\_\_
- c. Remarks: \_\_\_\_\_

Investigator Andy PurdyDate 12/12/77

Form #4-B

SELECT COMMITTEE ON ASSASSINATIONS *Kennedy*NAME Dr. Marion T. JenkinsDate 11/10/77 Time 4:50Address Parkland HospitalPlace Parkland Memorial HospitalDallas, Texas

Interview: By: Andy Purdy, Esq.

Dr. Jenkins (anesthesiologist) was one of the first doctors into the Parkland trauma room where the President was. He said the President's thick shock of hair largely covered up the head wound. However, Dr. Jenkins was positioned at the head of the table so he had one of the closest views of the head wound (believes he was " . . . the only one who knew the extent of the head wound.") His location was customary for an anesthesiologist.

Dr. Jenkins said he knew the President was non-resuscitable from his experience with many similar injuries (with the exception of the head injury). He noticed that blood gushed out of the head with each cardiac massage compression.

Dr. Jenkins said he bears the responsibility for the postponement in the determination that the President had expired. Because the President was his patient, he used an artificial respirator inspite of his professional determination that he was non-resuscitable.

Dr. Jenkins said he turned to a priest standing nearby and asked him what the Catholic Church's position is regarding what constitutes death and when the last rites must be adminis-

Interviewer

*Andy Purdy*  
(Signature)Andy Purdy

(Name)

Date Transcribed 12/2/77by L  
(II)

tered. He was told they must be given within two hours of a medical determination of death.

Regarding the head wound, Dr. Jenkins said that only one segment of bone was blown out -- it was a segment of occipital or temporal bone. He noted that a portion of the cerebellum (lower rear brain) was hanging out from a hole in the right -- rear of the head.

During the emergency medical procedures, Mrs. Kennedy came in the room and gave Dr. Jenkins a piece of the President's brain. Mrs. Kennedy, the priest, and Dr. Jenkins were the last three people to leave the trauma room.

Dr. Jenkins attempted to explain (on his own initiative) Dr. McClelland's Warren Commission testimony that the President had a wound of the left temple. He said McClelland did not personally see the wound and misinterpreted Dr. Jenkins' feeling the President's left temple for a pulse as indicating there was a wound there.



KENNEDY

006133

OUTSIDE CONTACT REPORTDATE 2/27/78 TIME 2:30

## I. Identifying Information:

Name Dr. John Lattimer Telephone \_\_\_\_\_Address Columbia Presbyterian Hospital, New York CityType of Contact: \_\_\_\_\_ Telephone \_\_\_\_\_  
☒ Person

## II. Summary of Contact:

Dr. Michael Baden, Mark Flanagan and Andy Purdy  
viewed a private slide and (brief) film presentation by Dr.  
John Lattimer concerning the Kennedy assassination-related  
work he has done and information he has accumulated.

Dr. Lattimer's presentation did not deviate from  
the substance of his articles. The movie was exceedingly brief  
and depicted experiments he had done firing Mannlicher-Carcano  
ammunition at filled skulls. In his test firings (at least  
those depicted) the skull went backward and to the left.

In addition to his review of the autopsy photos and  
X-rays, he has done repeated test firings of similar Mannlicher-  
Carcano ammunition. He believes the ammunition and rifle are  
exceedingly accurate and reliable. He postulates that the  
first shot occurred at Zapruder frame (Z)166 and was a miss  
III. Recommended Follow-up (if any):

Signature: Andy Purdy Mark Flanagan

deflected by a tree which broke up and/or imbedded itself in the street pavement. He believes the second shot occurred at about Z-220 and struck the President in the upper back, passing through him near the spine. Lattimer attributes the President's reaction (raising his arms coming from behind the sign) to an involuntary physical response caused by the shock to the spine (he cites "Cases of Injury to the Cervical Region of the Spinal Cord," 1889, by William Thornburn). He believes this second bullet caused the wounds to Kennedy and Connally. He indicated that the bullet which injured Connally "must" have passed through Kennedy first or the bullet would have had so much force that it would have passed through Connally's thigh (he believes the fragment was in Connally's femur). He said the "3 cm" wound in the thigh indicated a tumbling bullet, i.e., one which struck something else first (either JFK or a tree limb; latter not in alleged line of fire at Z-220). Asked hypothetically what inferences could be drawn if the Connally back wound was 1.5 cm, Lattimer said the bullet would have been tumbling. Lattimer said the only other cause of an elongated entrance wound would be a tangential bullet strike; however, he said a tangent strike on Connally would have caused horizontal elongation instead of the vertical elongation present on Connally. Lattimer's theory of 3 shots (with the first missing and burrowing into the pavement) accounts for the curb shot on the theory that it was a fragment from the head shot.

Lattimer has done no testing of bullet deflection by hitting trees; or of burrowing into pavement by such ammunition; or of simulation of the deceleration of a bullet which passed only through Connally to see if it would necessarily penetrate Connally's thigh.

Regarding his assertion that the vertical slit in JFK's shirt was because the bullet left him tumbling (and not merely characteristic of a bullet exit), Lattimer said he had neither seen nor done testing of this phenomenon

Lattimer said there was an irregularity of bone in the vicinity of the transverse process which he believes represents generally that a missile passed through the area and, specifically, that there was a fracture of C-6 or C-7.

Lattimer believes the "single bullet" struck Connally's rib (as opposed to a "slap wound"), flattening the bullet scraping off a piece of lead which he believes is visible in the Connally chest X-ray.

Lattimer believes the wrist wound was caused by a slowly traveling bullet because of the nature of the wrist damage (much less severe than if a bullet had hit it first) and the minimal fragment displacement evident.

Regarding the Edgewood Arsenal testing, he said the simulation of the head shot was very similar to the damage he noted in JFK upon viewing the autopsy photos and X-rays. However, he said they incorrectly used the autopsy doctors' figure for the location of the head entry wound, which is about 4" lower than the wound as seen in the photos and verified in the X-rays. He expressed mild surprise that the incorrect entrance wound point still resulted in approximate skull damage.

Connally wound characteristics which indicated to Lattimer that the bullet struck something else include (in summary): elongation of entrance wound; Connally's wrist "was



only in position" to be struck at time of JFK wound; Connally was seated directly in front of JFK; the bullet which struck the thigh would have shattered it if it hadn't been significantly slowed by tumbling.

Lattimer said he doubted that a fragment from the JFK head shot could have wounded Connally's wrist because the damage was caused by a fragment of <sup>too</sup>substantial<sup>a</sup> size to have caused the extent of damage evident in the X-ray.

Dr. Lattimer indicated that he has spoken to the autopsy surgeon, but doesn't have interview notes or transcripts. He does not have an explanation for the discrepancy in the location of the entrance wound in the rear of the head, believing it resulted from poor measurement techniques by individuals not sufficiently schooled or experienced in forensic pathology. He believes the autopsy doctors would realize their mistake upon reviewing the photos and X-rays.

Dr. Lattimer also stated that he spoke to Dr. Gregory (Governor Connally's wrist surgeon) several times about the nature of the damage in the wrist. Dr. Gregory is deceased.

On other subjects Lattimer said: He knows the generic origin of the rifle strap used by LHO; LHO practiced dry-firing his rifle according to Marina; Ruby's pistol had a metal shroud covering the hammer to facilitate its being fired from within a pocket or under clothing (he showed a photo which purported to be of Ruby's gun); and Ruby's psychiatrist (Bromberg) told him Ruby had his pistol with him earlier in the weekend at the police station.

Dr. Lattimer also suspects that Ruby fired his pistol using his middle finger as a trigger finger. Lattimer says that this allows the index finger to steady the barrel, and is an indication of familiarity in firing weapons.

SELECT COMMITTEE ON ASSASSINATIONS 5-40

NAME Dr. Malcolm Oliver Perry Date 1/11/78 Time 4:40 p.m.  
 University of Washington  
 Address Medical School Place Dr. Perry's office  
Seattle, Washington

**Interview:**

Dr. Malcolm Perry is currently a professor of Surgery at the University of Washington Medical School. He can be contacted at 206/543-3105. Andy Purdy and I interviewed Dr. Perry because of his participation in the medical treatment of President Kennedy at Parkland Memorial Hospital in Dallas, Texas.

Dr. Perry began the interview by stating that the intervening 14 years since the assassination have "not sharpened my recall." Dr. Perry then proceeded to relate his recollection of the wounds of President Kennedy and of the medical treatment the Parkland doctors administered to JFK.

Dr. Perry began by stating that one of the wounds that JFK had suffered was "about 1/3 of the way" up on the anterior aspect of the neck. Dark blood (a sign of insufficient oxygen) was oozing from the wound when Perry first observed JFK. Dr. Perry believes that the wound measured approximately 6-7 mm in size and was roughly round, although he couldn't state for sure since combating the two primary medical emergencies of restoring breathing prevented him from even taking the time to wipe

Interviewer

Andy Purdy T. Mark Flanagan, Jr.  
 (Signature)

Donald A. Purdy, Jr. / T. Mark Flanagan, Jr.  
 (Name)

Date Transcribed 1/30/78 by mc

the blood from the wound. Perry said that Dr. Jones, who was already treating JFK when Perry arrived, had inserted a tube down the trachea to facilitate breathing but that the air passage still seemed blocked. Due to this dilemma, Dr. Perry determined that a tracheotomy was necessary "then or never" and therefore made a transverse incision straight through the bullet wound on the anterior aspect of the neck at approximately the second or third trachea ring. While Perry performed this operation, Dr. Jones initiated I. V. treatment. At approximately this time, Drs. McClelland, Barter, and Peter arrived to assist in the treatment of President Kennedy.

Based on his examination of the trachea, Dr. Perry stated that the lateral wall of the trachea was damaged and had the characteristics of a penetrating rather than a blunt trauma. In the vicinity of the strap muscles, Dr. Perry observed some discoloration of the pleura; it looked like "it was bruised, with some blood" present. Perry stated that on the basis of this observation alone, that the blood could have been from the trachea or the lung. For this reason, other Parkland doctors inserted chest tubes into JFK's chest to help treat any possible injury



to the lungs. Perry then surmised that on the basis of the lateral wound to the trachea plus the skin wound on the anterior portion of the neck, that some type of pathway from a bullet was present but that the exact trajectory was very difficult to determine since bullets do not necessarily travel in straight paths, particularly if they are partially spent.

Perry followed this statement by saying that there was no discernible path. Further, at no time during his treatment of JFK was Perry aware of the wound in the President's upper back. Dr. Perry also stated that little bleeding was coming from this wound and that based on his observations, no major artery had been hit in this area.

Dr. Perry, an expert in arterial injuries, stated that the amount of blood loss or the degree of arterial injury can rarely be diagnosed through blood pressure and that a major artery can be struck without necessarily causing major blood loss.

Dr. Perry also mentioned that during his treatment of President Kennedy other Parkland doctors began cardiac massage which lasted approximately twenty minutes. At the conclusion of the cardiac massage, Dr. Kemp declared JFK dead.

Dr. Perry stated that the throat wound alone probably was not fatal and would not have prevented JFK from speaking.

Perry "looked at" the head wound "but didn't examine it." He believed the head wound was located on the "occipital parietal" region of the skull and that the right posterior aspect of the skull was missing. Dr. Perry did not detect or look for any possible entry wound in the rear of the head.

Dr. Perry stated that Dr. James Carrico, then a first-year resident, recalled that the President may have had Addison's Disease and therefore administered steroids to combat any possible shock that may have occurred. Dr. Perry also stated that steroid treatment tends to produce a sense of euphoria. Dr. Perry could not recall if Dr. Burkley, the President's physician, had also given the Parkland doctor steroids to administer to JFK.

Dr. Perry stated that after Dr. Kemp Clark had declared JFK dead, he proceeded upstairs to where other doctors were attending Governor Connally. He specifically aided Dr. Thomas Shires who was operating on Governor Connally's thigh wound. Dr. Perry's role in this treatment

was limited to determining whether the bullet had struck an artery. Dr. Perry stated that it had not.

Dr. Perry described the wound to Governor Connally's thigh as superficial. In regard to the fragment shown in the X-ray of Governor Connally's thigh, Dr. Perry stated that it appeared to be imbedded in the thigh. Perry stated that it is normal procedure not to remove fragments so long as they pose no harm (such as being very close to a major artery) since fragments themselves would not cause infections. What's harmful are the threads of cloth a fragment will sometimes carry into a wound when it travels through clothing.

After showing Dr. Perry a tracing from one of the autopsy photographs of the tracheotomy wound, Dr. Perry stated that the small half sphere in the bottom of the sketch along the perimeter of the incision was quite likely part of the bullet wound. He did say, however, that this irregularity could have been caused from the weight of the tracheal tube which can deform the perimeter of the incision.

This interview was concluded by a taping session concerning a concise description of JFK's wounds.



KENNEDY

006370

INVESTIGATION INTERVIEW SCHEDULE1. Identifying Information:

Name Dr. Malcolm Perry Date 1/11/78  
Address University of Washington Place Same  
City/State Medical Center  
Seattle, Washington Telephone \_\_\_\_\_  
Date of Birth \_\_\_\_\_ M or S \_\_\_\_\_  
Social Security \_\_\_\_\_ Spouse \_\_\_\_\_  
Children \_\_\_\_\_

2. Physical Description:

Height \_\_\_\_\_ Color Eyes \_\_\_\_\_ Hair \_\_\_\_\_  
Weight \_\_\_\_\_ Special Characteristics \_\_\_\_\_  
Ethnic Group \_\_\_\_\_

3. Personal History:

- a. Present Employment: \_\_\_\_\_  
Address \_\_\_\_\_  
Telephone \_\_\_\_\_
- b. Criminal Record
1. Arrests \_\_\_\_\_
2. Convictions \_\_\_\_\_

4. Additional Personal Information:

a. Relative(s): Name \_\_\_\_\_  
Address \_\_\_\_\_  
\_\_\_\_\_

b. Area frequented: \_\_\_\_\_

c. Remarks: \_\_\_\_\_

Investigator Andy Purdy/Mark Flanagan

Date 1/11/78

Form #4-B

## SELECT COMMITTEE ON ASSASSINATIONS

NAME Dr. Malcolm Perry Date 1/11/78 Time 5:45 p.m.  
 Address \_\_\_\_\_ Place University of Washington  
Medical Center  
Seattle, Washington

## Interview:

FLANAGAN: Staff members present are: Andy Purdy, Staff Counsel; Mark Flanagan, Staff Researcher. We are interviewing Dr. Malcolm Perry.

PURDY: Okay...and then, Dr. Perry, you could please acknowledge that we are taping you and that this is with your permission.

DR. PERRY: This is with my permission and I am here.

PURDY: This will all -- let the record show that we have just had a discussion which began approximately 4:30 -- this, of course, is Pacific time -- where we went through the chronology of events of November 22nd, 1963, which you were involved in, and your specific recollections about the treatment and the wounds. Is that correct?

DR. PERRY: That's correct.

\* \* \* \* \*

PURDY: Dr. Perry, could you please state your present position.

PERRY: I'm Professor of Surgery at the University of Washington, vascular consultant and chief at Harbor View Medical Center.

PURDY: Could you please tell us what experience you've

Interviewer \_\_\_\_\_

Andy Purdy (Typed)  
Mark Flanagan (Typed)

Date Transcribed 3/9/78 /am

had with gunshot wounds since 1963.

PERRY: Well, happily, it hadn't been exactly the same, but I've had quite a bit and I remained after 1963 when I returned to Parkland and University of Texas Southwestern Medical School from California as an Assistant Professor of Surgery. I stayed there until 1974, and during that time I remained as Chief of Vascular Surgery at Parkland Hospital and the VA Hospital and had the opportunity to treat numerous traumatic wounds of all types -- gunshot, knife, blood trauma, and over the ensuing years up till 1974 around several hundred cases. And then subsequent to arriving here, and inasmuch as I run a trauma service at Harbor View Medical Center, I've had the opportunity to continue to treat traumatic wounds of all types -- probably, oh, several every month. I don't keep a compilation. Those figures are available in my records, of course, but I don't have it off the top of my head.

PURDY: Could you describe, generally, President Kennedy's condition when you entered the room and what treatment was under way.

PERRY: When I reached the emergency room at Parkland that day, the President had just been brought in and the initial resuscitation was under way. There were several people in the room -- the nurses and several doctors. And Dr. Jim Carrico, who was the first-year surgical resident in charge in the emergency room, was attempting to establish an airway. He had a laryngoscope in his hand and was attempting to get an endotracheal tube in. IV's were being started and the President's clothing was being removed to



permit us access to the limbs for intravenous fluids and resuscitation and placement of various catheters and tubes. He had agonal respiration. I attempted to feel for a pulse in the left groin and didn't feel one. And Jim said he had no blood pressure but that he was breathing. And he also apprised me at that time that there was a wound of the trachea that he could see through the laryngoscope, but he couldn't get the tube past it -- it was too far down. And I asked for a tracheostomy tray, and Betty Hinchcliffe, one of the nurses, had already prepared it, and I dropped my coat in a corner and put on some gloves and started to prepare to do a tracheostomy to get the airway. At that time I noted a wound in the anterior aspect of the neck in the lower third which was roughly round, exuding, very slowly, dark blood, partially obscuring its edges. The wound was somewhere, probably 4 to 6 mm in diameter. I did not have her wipe the blood off and inspect the wound and gave it a cursory glance while I was putting my gloves on and preparing the trache tray. I also asked at that time that several other doctors, specifically, McClelland, Baxter and Dr. Clark, be summoned from the medical school to come and help. And I asked Dr. Jones to start an IV, and Dr. Carrico, who was also busy with another IV at the same time, I think in the leg, as I recall it. And then I took the knife and I cut directly through the anterior neck wound in an attempt to secure control of the trachea and the tracheal injury that Jim had mentioned. I noticed a head injury, but I didn't examine it at that time, but I did see some evidence of brain tissue on the cart. I reached

the trachea and the strap muscles, which were bruised as I previously noted in my testimony before the Warren Commission, and at that time I secured the trachea with an Allis clamp and brought it up to the field and I saw the injury to the right lateral aspect of the trachea where it had been damaged and I cut into the trachea at that spot and started to place an intratracheal tube in. And about that time a set of hands came into field to help me, which later I identified as Dr. McClelland's, and we completed placing the tracheostomy tube into place and hooked him up to the respirator. Because there was some bruising and also some bubbly looking blood over there on the right serial pleura, upper portion of the chest, why I thought perhaps there might also have been a hemo- or pneumothorax accident. I asked Dr. Baxter to put in a right chest tube, which he did. And Dr. Jones put in a left one, I think, about the same time. And the respirator was going. I didn't see any other evidence of injury and there was very little bleeding because he had no obtainable blood pressure. There didn't seem to be anything else hitting the neck other than the trachea and some of the muscles on the looser radial tissue and the bruised apical pleura. About that stage, Dr. Clark had arrived and he told me that the electrocardiograph indicated that cardiac arrest had just occurred, and so we started closed cardiac massage. And we persisted with that until it became apparent that it was futile. And Kemp said, "well, it's too late to get him back," and so I quit.

And I looked at the head wound briefly by leaning over the table and noticed that the perietal occipital head wound was largely evulsive and there was visible brain tissue in the macard and some cerebellum seen and I didn't inspect it further. I just glanced at it and I went on outside and later was summoned up to the operating room to help in the care of Governor Connally.

PURDY: Could you give us a characterization of the edges of the anterior neck wound?

PERRY: Yeah. I previously pointed out that they were neither ragged nor clean-cut. I suppose that's a misnomer because, actually, I didn't inspect it that well. What I meant to infer by that initial description was the fact that I couldn't see a clean punched wound; it was roughly round, the edges were bruised and a little blurred because, as I mentioned, there was several big drops of old blood, and some of it coagulated, of course, on and about the wound, so I didn't really inspect the margins carefully. I think the terms I used before was neither ragged nor clean-cut -- and that may not have been appropriate. I should have probably said I couldn't see 'em that well -- it might have been a better answer.

PURDY: You described the damage to the trachea as you saw it. Was there some further description you can give of damage? I think you stated previously, for example, that there were some bruises...



PERRY: Yeah, it's on the right lateral side of the trachea -- there was a laceration. But again, I don't remember exactly how I put that all these years ago, but it was on the right side of the trachea, and that it was incomplete, and I don't remember whether it was a third or a quarter of the circumference, and -- I can't remember exactly. There was a laceration. The bruising that I mentioned was in the apical pleura and the strap muscles. The trachea was clearly lacerated.

PURDY: You also stated prior to the taping that there was possibly some damage in the mediastenum?

PERRY: Mediastinum.

PURDY: Mediastinum?

PERRY: Yeah. That's that same area. The mediastinum is that area that's bounded by the lungs on each side, and the sternum in front, and the spine in the back. Contains the heart and all the great vessels and various structures.

PURDY: You described the use of the chest tubes to determine whether or not there was any pneumothorax or hemothorax...

PERRY: Let me...actually not to determine, Andy, but to treat. I didn't know whether there was or not. I surmised there might well be a hemothorax or pneumothorax because, not knowing the trajectory of the -- of the missile, and when I saw the bruised apical pleura and there was some bubbly blood in that area, and I didn't know whether that blood had been frothed a little bit as a result

of air coming out of the trachea in our attempts to breathe for him or whether it was coming out of a lung. And as a result, since a tension pneumothorax or serious chest injury could have obviously been a serious problem, why we elected to put in a chest tube. But the chest tube, I later learned, was not necessary because the chest cavity was not violated -- but I didn't know that at the time. It wasn't done diagnostically; it was done therapeutically.

PURDY: How did you determine that the pleural cavity was not violated?

PERRY: Found that out later in the autopsy report.

PURDY: Was your feeling at the time that you finished your treatment that the pleural cavity had been violated or you...

PERRY: Didn't know -- didn't have any idea. I didn't -- we didn't do any more. After Dr. Clark and I decided that resuscitation failed, why I didn't do anything else, so I don't really know. I didn't find that out until some time later.

PURDY: What did your inspection of the anterior neck area disclose to you about the condition of major vessels in the area?

PERRY: Well, of course, that didn't tell me anything. As we discussed a little earlier, he had no blood pressure that was obtainable, and therefore, there was essentially very little bleeding. Even if he had had a major arterial injury, why he might have bled out and there wouldn't have been much; but there was no evidence of a major arterial injury. And the artery, the course that's closely applied to the trachea is the common carotid artery at that level. But it was not injured.

PURDY: Would President Kennedy have survived if he had only suffered the injury to the neck?

PERRY: Assuming the lack of complications, the odds are quite well and good that he would have. Occasionally, tracheal wounds are associated with subsequent stenosis and required repairs, but they generally--a wound such as this is usually survivable -- yes.

PURDY: To what extent, if any, would the President's speech have been impaired in the short or the long term?

PERRY: Well, this is again some of that conjecture that got me in a lot of trouble before, but I suspect very little. There's no reason why he couldn't talk with that particular injury that was temp...an artery -- that's not enough to keep him from talking. It was below the larynx and it wouldn't have been, constituted enough of an air leak so make him so breathless that he couldn't speak.

FLANAGAN: Dr. Perry, could you go over and describe the conversations that you subsequently had after treating the President at Parkland with Dr. Humes, the surgeon who performed the autopsy?

PERRY: Yeah. This won't be too accurate, Mark, because I found out, interestingly enough, that later I had my dates a little bit fouled up. They called me twice and I couldn't remember -- I didn't write 'em down. I've learned to keep better records since then, but -- and I didn't remember exactly when they called me and about what, but I was called twice back from Bethesda. And the conversation of the first one, as I recall, and I need, I should go back and look at my testimony in my notes here



and I haven't done that, I guess, I should have to find out exactly what we're talking about on that first one. But we discussed the thing and I told him about the tracheostomy wound and told him that I had cut right through the small wound in the neck. And Dr. Humes at that time had described that they had had a little difficulty tying up that posterior entrance wound -- as allegedly to be an entrance wound, I shouldn't get in this hot water -- that posterior wound with the -- couldn't find out where it went. And they surmised that during the cardiac massage and everything that perhaps the bullet had fallen out -- which seemed like a very unlikely event to me, to say the least. But at any rate, when I told him that there was a wound in the anterior neck, lower third, he said: "That explains it!" I believe that was the exclamation that he used -- because that tied together their findings with mine. Now there was a second call about the chest tubes, I think. And I believe that was the next day. I'm not sure of that. Maybe they called me twice that morning.

PURDY: At one point in your testimony, to help clear it up with you, you said that the calls came about 30 minutes apart.

PERRY: Was it twice in the same morning? It's possible. There should be something in the record of that. They had a record of it, Andy, and I just don't remember, you know. Between Friday and the President and Sunday and Oswald, and all those conferences and interviews, I got a little bit confused -- 'cause Saturday morning I was asked to come up to the hospital and talk to a whole bunch of people and so I was up there Saturday too. And I don't

remember -- but maybe it was two, both...

... Saturday was when they called?

PERRY: Yeah, twice.

FLANAGAN: I believe so.

PERRY: But they called twice. And they asked me about the chest tubes--or something to that effect. Was it chest tubes?

PURDY: Yeah. In your testimony you say that "the initial phone call was in relation to my doing a tracheotomy," and you informed them...

PERRY: ...that I'd cut right through the wound.

PURDY: Right. Do you remember whether or not there was any discussion in either of the calls about whether there had been any surgical incisions made in the President's back?

PERRY: I don't remember. I don't know why they would. He might have asked me, but I didn't even look at his back--so I wouldn't have known the answer to that if there had been. But I don't recall him asking that question. He might have asked -- I got asked so many questions along about that time, I don't remember who asked them. I didn't even look at Mr. Kennedy's back -- which was another thing I wish we'd have done.

FLANAGAN: One further question on these lines. To your knowledge, did the Bethesda Hospital or Humes -- did they ever receive any, for instance, handwritten notes that might have been taken by them...

PERRY: Should have.

FLANAGAN: ...I mean after the assassination.

PERRY: Yeah. You know, we -- yeah, that's a good question, too, Mark, because we all sat down afterwards and wrote out in our own -- as Lil Abner would say, hand writ -- notes our recollection of what happened down there, knowing that we'd get a little fuzzy about it. And I think they got copies of those; I'm not sure of that, though. Those copies were available, because we made them available to the investigating committees, and I know our inspector and all the guys around here. We all wrote down some of them and they were available for everybody. I think several of the people from various investigating agencies looked at 'em. They made a bunch of copies and they should be widely circulated. Interestingly enough is the discrepancy between what people remember -- it's kinda like the blind men and the elephant -- that's what they remember. Dr. McClelland's and some of the others' are quite different from some of ours -- which I thought...

FLANAGAN: Is this normal procedure -- that Parkland Hospital would follow writing down...

PERRY: No. Normally, what we do -- well, normally, yes; but normally just one of us. Normally, the guy -- myself, for example, since I ostensibly was responsible for the surgery and the rest of it, normally the guy who's attending and who's doing the job writes a summary about it afterwards for the record. The reason all of us did was we thought it might be important -- more than the usual -- to have a good record. I'm not sure it served its purpose. I haven't read everybody's, but I've read some of them and I found they didn't correspond with what



I remembered.

PURDY: Do you remember any in particular?

PERRY: No, no, but I remember the stuff about Bob McClellands.

We talked about that later because we talked about the thing in the temple. And we all kind of laughed about that but I just, you know, Bob was told when he joined in there and like me he didn't spend much time because he saw I needed help. And when he started helping me with the trache, he asked where he was shot. And somebody told him he was shot in the left temple and he accepted that as being true, when actually it wasn't true and I think Bob wrote that down -- or if he didn't write it down, he told somebody that, which was interesting. But, you know, you get naive and trustworthy and that's a bad way to be.

PURDY: As you recall, your testimony says that the second conversation you had with Dr. Humes was in regard to the placement of the chest tube for drainage of the chest cavity.

PERRY: It's interesting to me -- and I'm not being critical-- but it's interesting to me that the pathology report does not reflect that. The autopsy report said that those incisions were made to combat subcutaneous emphysema, which is not a -- in the current jargon -- a viable therapeutic technique.

FLANAGAN: What would have been a normal routine, if it existed at the time, after someone taken into emergency expired, and then you wrote up some reports...

PERRY: What do we usually do?

FLANAGAN: What would occur then with the reports, for instance?

PERRY: They'd go in the hospital records.

FLANAGAN: Hospital record with the forensic pathologist in the area that might examine the body...

PERRY: Yeah, they're all there. It all goes in the record. We'd write a narrative summary and I must say, if I may be a little bit immodest, I write mine right away. I'm very good about that sort of thing -- mainly because I found that if I do it right then, it's like an operative report. When I come out of the operating room I dictate the operative report right then because it gets progressively hazier. And I usually sit down and write it as soon as I finish. I write a short op. note anytime I do an operation on the chart. We prepare them right then. And that's what we would do. And that would become a part of the legal hospital record.

PURDY: To what extent, if any, did your observation of the nature of the President's wounds in the anterior neck convince you that a missile of some kind had gone through that area?

PERRY: Well, I suppose I could enumerate those, Andy. It's kinda like, you know, I can look at you and Mark and I tell -- I know which one's which without enumerating the features of your physiognomy. I've got a picture of you in my head now. Well, it's the same thing with this. When I looked at that -- there's an injury to the side of the trachea, there's a wound in the front of the neck, there's some concussive damage to surrounding organs -- these are the kind of things one sees with gunshot wounds in a blast injury and that sort of business. And with high velocity when you see a lot. Now the low velocity stuff -- it's often just a track, a wound track, with very little

concussive or blast injury. And this one was in between. There was evidence of some blast injury, but not like, say, one sees with a high velocity rifle like a 3006 or 223 or something. This is quite different.

PURDY: Did your observations of the nature of the wounds give you any information as to the possible trajectory of a missile through the President?

PERRY: No, I really can't say that. I can speculate again, and I did speculate about that -- but all I can say is if you were to tie up the wound in the neck, the wound in the trachea, and the strap muscle business, apparently something passed that way. And as I mentioned earlier, the pathway of bullets striking tissues of varying densities is not uniformly rectilinear -- it curves and moves with it -- and they may be deflected by what appears to be a relatively minor structure -- a tough fascia layer, a muscle layer, or something -- it may deflect the bullet, especially if it's down, if its energy's low and it's down near the bottom of its velocity curve, it may be deflected in travel for long distances in a circuitous fashion. So I think it's very chancey business to make conjectures about trajectory when you don't have the whole wound track exposed and you're just looking at two points. We never probe wounds, for example, that's ridiculous; it doesn't help you a bit. And you get all kinds of wounds in which you try to project where it went, and that's an exercise in futility, usually. So, I don't know where it went.



That may be more than you wanted to hear about that, I don't know.

PURDY: Do you have an opinion based on those two points that you described as to the origin of the missile that caused the damage?

PERRY: No, I don't, and the reason is that I didn't clearly identify either an entrance or an exit wound. In the press conference I indicated that the neck wound appeared like an entrance wound, and I based this mainly on its size and the fact that exit wounds in general tend to be somewhat ragged and somewhat different from entrance wounds. Now, this doesn't pertain, of course, in bullets that are deformable or in bullets that are tumblers, and many bullets, especially fired from the handguns and this sort of thing, tend to tumble, and as a result, they make keyhole injuries and various things. But in general, full jacketed bullets make pretty small entrance holes. And so I don't really know. I thought it looked like an entrance wound because it was small, but I didn't look for any others and so that was just a guess.

PURDY: Based on your observations of the wounds, was it more likely that the damage was caused by a missile or something like a small bone fragment?

PERRY: Oh, I think it's more likely to be a missile from that than bone fragment. The only reason I say that is that secondary missiles, which is what a bone fragment would be, generally don't attain the velocities that produce this sort of thing. They can, but usually would not at that level. Remember Governor Connally

had some secondary missile damage as a result of a bullet striking his fifth rib and the rib acted as a secondary missile. But that's not the usual and I think it's probably just...

PURDY: Is it possible that the missile which caused the wound in the anterior neck could have fractured the transverse process and still resulted in the type of wound that you saw?

PERRY: I suppose so. Again, you're asking me to make a lot of suppositions which get me in trouble, but I suppose so. If one had a fairly high velocity missile that was full jacketed, it would have enough remaining velocity to go on through after striking something, like a transverse process -- it could get on through. You're talking now about tangential wounds and thickness of bone and all this sort of thing, and we don't even know bullet types. So these things are possible, yes, but it doesn't seem very likely. But again, that's a guess and it's not worth any more than that -- than a guess -- on my part.

PURDY: Based on your experience with wounds in these intervening years, have you been able to draw any firmer or any different conclusions based on the nature of the wounds you recall?

PERRY: Do you want a short answer? Or a long answer?

PURDY: Like whatever answer you want to give.

PERRY: Okay, let me give you a medium answer, but with a qualified anecdote. The answer is no, I haven't. I haven't changed my mind about any of it and the reason is I have no new information. As I mentioned earlier, 14 years hasn't sharpened my

recall. I've told it as well as I can remember it. But I did it best when I was fresh -- and things change a little bit. But I was just telling you, just night before last I had a young lady shot with a 3006. We had a multitude of wounds in that young lady, and they were hard to explain. Her right humerus was shattered with an injury to the artery and the ulnar nerve was transected. The whole back of her arm was blown off. She also had a fractured radius in the left arm with no injury to the artery. It was fractured and there was no fragments in that wrist. She also had a wound to her left neck area, and a fragment was in there. We had the devil's own time trying to figure it out and then later we found out what happened. She was shot, and with a 3006 hunting rifle, high velocity, which blasted her arm pretty good. The bullet hit the concrete, shattered, and those other two were secondary injuries from the fragments that got her arm and got her neck. But we didn't know that. And this is the kinda thing you can get into. So I don't know.

FLANAGAN: Dr. Perry, you mentioned earlier that after you had been down <sup>/in</sup> Trauma Room 1 administering to President Kennedy that you then went over to see Governor Connally in the Operating Room -- I guess that's upstairs in Parkland Hospital.

PERRY: Second floor

FLANAGAN: Could you relate the scope of your involvement in treating Governor Connally?



PERRY: Yeah. When I left downstairs I went outside a minute and sat down and then they called and asked me if I'd come up to the OR where Dr. Shires was operating on Governor Connally's leg. Dr. Shaw and Dr. Gregory had been involved, of course, when we were working on chest and arms and this sort of thing. He had a penetrating injury of the left thigh, as I recall, kind of anterior-medial and so I went up and got a scrub suit, changed clothes, and went back to the OR -- which was my operating room, as a matter of fact, back in OR5 where I usually worked -- and Dr. Shires was looking at the wound. They'd incised the skin; and were looking at the thigh wound, and I just looked over his shoulder and agreed with their opinion that the wound was not serious, that it had not penetrated deeply into the leg, that the artery was not in danger, and that it wasn't necessary to expose the artery.

PURDY: Could you describe the approximate size and depth of the...

PERRY: No, Andy, I'm no help because the skin incision had been made and -- but the tissue looked fine. It didn't look like there was much of anything wrong with it. So, whatever it was, it was near spent, I suppose, or it was very minor because there was none of the type of thing one sees with any velocity in a missile, any significant velocity.

PURDY: Was it your opinion that it was a full bullet, part of a bullet, or a very small part of a bullet that caused the wound?

PERRY: Well, I don't know because there was so little wound I don't think I can say that -- but I was underwhelmed with what I saw, as the saying goes. It didn't look to me like much of a wound at all when we saw it. There wasn't much to it. Again, that's qualified because I didn't see the skin before...

FLANAGAN: What was the doctors' concern, if any, over the fragment that was in the thigh of Governor Connally?

PERRY: Well, the question came up whether that could possibly have come from a fragment that went zipping down through there and might have damaged some of the neurovascular bundle. As we indicated earlier, Mark, you're not really so concerned with the fragments themselves but what may be between where they began and where they ended. And inasmuch as where this wound was and the size and the scope of that fragment, we deemed it highly unlikely it caused any significant damage. And as I said, I was underwhelmed with the whole thing. I don't even know that that fragment wasn't there from before. I mean, we have no previous X-rays of that area. I guess it came then, but I've become a little more suspicious in my older age and seen people that have injuries that you don't know about. I don't know how long that had been there. No controls.

PURDY: Dr. Perry, I think that finishes the formal questions we had and we wanted to give you an opportunity to expound on any aspects of the nature of the wounds that you didn't have sufficient time or any items which perhaps had been left unresolved by previous testimony.

PERRY: Yeah, I...

FLANAGAN: Suggestions or comments

PERRY: Yeah, I feel I've already cluttered up your tape with a lot of professorial homilies and aphorisms throughout the course of this thing and I'm sorry about that, but it, you know, you make this a stilted one but I hope not to. No, I don't have any other comments. I wish to hell I remembered a little better and I wish I could add something substantial to your investigation, but I fear that I have no new information. I wish I had not speculated as to where the wounds came from. As I said, after our operation on Mr. Oswald when I had the press conference, at that time I had a typed prepared statement of what I had done when I operated on him and I didn't answer any questions. I found that was a very -- much better way to do things. And there was no hypothetical questions, no suppositions -- a typed statement was handed out and I didn't get in a lot of group discussions about what might have been. But I don't have anything else to add. I don't have any new information.

PURDY: One final short question. Did you or any of the doctors consider initiating any communications with the autopsy surgeons prior to the completion of the autopsy?

PERRY: No, we didn't and perhaps we were remiss in not doing so. It might have been a good idea. We ordinarily do that, as you know, and your question is very germane to what's going on here because ordinarily if I have a patient that dies very recently I usually call the pathologist down and we'll talk about it before and usually I try to attend the autopsy if it's done at



a time when I'm not in the operating room because it's an important part of our ongoing education. We always learn something. And I always tell 'em what I'm worried about. And sometimes I even assist in the autopsy if it's a specific case where that I think perhaps that the patient I operated on and the knowledge that we get from that is helpful. And perhaps we should have called Commander Humes. It would have helped a lot had we done that, but the circumstances in which Mr. Kennedy was removed from the hospital were precipitative and abrupt, and most of us, quite frankly, weren't asked or consulted or anything about any of it and it was all just done. And as a result, we were essentially moved out of the area of environment and involvement and we assumed that that was it. And I -- perhaps that was our error. It'd been nice if we'd of talked to them before they started; I think we could have helped them a lot. And we probably should have initiated that ourselves, knowing what we knew.

PURDY: Thank you. Okay, Time is now 6:15. This taping session is over.

FACSIMILE - No. 003490

KENNEDY

F-296

## SELECT COMMITTEE ON ASSASSINATIONS

Name Dr. Jack Reynolds Date 11/9/77 Time 2:15 - 3:45  
Address Parkland Hospital Place Dallas County Department  
Dallas, Texas of Forensic Sciences  
Dallas, Texas Dr. Charles Petty's office

## Interview:

Dr. Reynolds was the radiologist who conducted the X-raying of the wounds of Governor Connally. He submitted nine Reports of Diagnostic X-ray Consultation pertaining to the examination of these X-rays. These reports occurred between 11-22-63 and 12-4-63. Andrew Purdy and myself interviewed Dr. Reynolds for two reasons:

- (1) to determine if Dr. Reynolds had any additional comments or corrections to make concerning Gov. Connally's X-rays; and
- (2) to show Dr. Reynolds the enhanced versions of Gov. Connally's X-rays.

Dr. Reynolds had no new revelations; his comments can be summarized as follows:

(these observations are based on the examination of the original and enhanced X-rays)

Interviewer Signature \_\_\_\_\_

Typed Signature T. Mark Flanagan, Jr.

Date transcribed \_\_\_\_\_

By: \_\_\_\_\_ Form #4-

- 1) Wrist - After examining the original and the enhanced X-rays, Dr. Reynolds stated that there are at least four fragments of metal identifiable in Gov. Connally's wrist wound. Further, since these fragments are all volar to the wrist bones, this indicates that the missile traversed the wrist from the dorsal to the volar side. Dr. Reynolds stated that all of these fragments are extremely small in size; he stated that the actual size could possibly be ascertained but that the density and thus mass would remain unknown. Dr. Reynolds stated the [sic] Gov. Connally's wrist suffered a comminuted fracture, which means fractured into three or more pieces. Dr. Reynolds also stated that he was not qualified to determine whether the missile struck the wrist directly or tangentially.
  
- 2) Thigh - Dr. Reynolds stated that only identifiable opacity exists in the thigh X-rays and that it definitely has metal characteristics. He stated that his 11-29-63 report, describing the location of this fragment as just beneath the skin in the region of the subcutaneous fat, is correct. The fragment is definitely not imbedded in the femur.



Place: Dr. Petty's Office  
Dallas, Texas

- 3) Chest - Dr. Reynolds stated that the X-rays show two areas of abnormality within the fifth rib. One area shows approximately 10 cm of the fifth rib missing; the other area is a simple fracture which Dr. Reynolds feels resulted from the stress of a missile striking the area where the 10 cm is missing. Dr. Reynolds stated that no metal fragments are present.

After terminating the discussion of the substantive issues, Andy and myself advised Dr. Reynolds that he could contact us at anytime if he had any additional comments or questions regarding Gov. Connally's X-rays or the assassination generally.

Also present during this interview:

- 1) Dr. Charles Petty - Director of the Dallas County  
Dept. of Forensic Sciences
- 2) Dr. Robert R. Shaw - the thoracic surgeon who  
attended Gov. Connally.

## OUTSIDE CONTACT REPORT

FEBRUARY 27, 1978.

## I. IDENTIFYING INFORMATION

Name: Dr. William B. Seaman.

Telephone: \_\_\_\_\_

Address: Columbia Presbyterian Hospital, New York City.

Type of Contact: Telephone.

X Person.

Contact By: Andy Purdy  
Mark Flanagan

## II. SUMMARY OF CONTACTS

Dr. Seaman examined the JFK and Connally X-rays in the presence of Dr. King, Dr. Michael Baden, Mark Flanagan, and Andy Purdy. He made his preliminary observation before his attention was focused on areas of particular interest to the medical panel.

**JFK**—Regarding the lateral skull X-ray, Dr. Seaman said pieces of metal were strewn in a track-like manner. Fractures were evident through the upper part of the right eye, including the top and bottom of the right orbit. The bottom of the frontal sinus was fractured. At the upper rear skull point of possible defect in the skull, Dr. Seaman said it could be an entrance wound and could not be a missile exit wound. He said he could not denote leveling of the skull at that point.

## III. RECOMMENDED FOLLOW-UP (IF ANY)

He found inferences difficult to draw from the extensive damage to the top of the skull, which includes overlapping skull pieces. The lower head was fairly intact, with no evidence of entrance or exit in the region ("very unlikely"). The upper point (mentioned earlier), "suggests entry, but is not conclusive."

Regarding the neck X-ray, Dr. Seaman said there was a fragment-like object present near the transverse process which is too dense to be bone ("fairly confident"). He said the transverse process appears abnormal with air present (possibly by-pro of tracheotomy) calling it "\* \* \* highly suspicious compared with the other side." He thinks he can "\* \* \* see the fragment separate (also in No. 9), and concludes there is a possible fracture in C-7.

**Connally—Wrist**—Comminuted fracture with fragments. He was not sure if the fragments were on the entrance (volar) or exit sides. Dr. Seaman concludes from the spatial orientation that they are fragments of metal.

**Thigh**—Dr. Seaman denoted a fragment of metal in the subcutaneous tissue, characterized by a tail-like end which make it recognizable on both thigh X-rays and insures it is not bone. There is no metal fragment in the femur.

**Chest**—Dr. Seaman noted an area of consolidation and fluid in the right chest. In the fifth rib he noted a fracture and fragment of bone in the anterior axillary line with evidence of hemorrhage, and air in the axilla.

Regarding the possible existence of a higher fracture in the fifth rib, Dr. Seaman said he was a "little skeptical" of it as a fracture, because he couldn't see it fractured all the way as evidenced in a subsequent (even now) X-ray might provide more information about exactly what happened. Dr. Seaman found no evidence of metal fragments in the chest, and couldn't form an opinion as to the nature of the object visible on the left side.

Dr. Seaman had no one to recommend who is an expert in forensic radiology. He did say Dr. Juan Taveras, of Massachusetts General Hospital (Boston) is a skull expert who might have something to contribute.



**SOUTHWESTERN  
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005095

Office of the Director

February 2, 1978

Mr. Donald A. Purdy, Jr.  
Staff Counsel  
Select Committee on Assassinations  
U.S. House of Representatives  
3331 House Office Building, Annex 2  
Washington, D.C. 20515

Dear Mr. Purdy:

At 1:05 p.m. on November 9, 1977 Robert R. Shaw, M.D. former Professor of thoracic surgery at Southwestern Medical School was interviewed in my office at the Institute of Forensic Sciences. Present at the time of the interview were Mr. Donald A. Purdy, Jr., T. Mark Flanagan, Jr., and of course Doctor Shaw and myself.

Doctor Shaw appeared to be a very healthy, enthusiastic man whose powers of recollection are excellent, although some of the observations that he related were obviously somewhat stereotype because of many previous interviews regarding the subject at hand. To a very marked degree the information and answers given by Doctor Shaw were similar to those reported in the article published in volume 60, January 1964 of the Texas State Journal of Medicine.

I shall attempt to condense what Doctor Shaw related to me at the time of the interview for ease of reading. I will put the report in the form of a series of very small paragraphs. You already have the original diagram made by Doctor Shaw illustrating the point of entrance and exit of the bullet in J.B.C. and also showing to the best of his recollection the actual size of both the entrance and exit wounds.

J.B.C. was lying on his back when first seen by Shaw. A 5 cm. greatest dimension wound was present just below the right nipple. It was irregular in shape, sucking and there was paradoxical motion noted.

Lateral to the scapula on the right posterior thoracic wall was a small wound.

Doctor Shaw debriefed the anterior wound.



There was a tunnel made by the missile in passing through the chest wall.

The bullet struck the fifth rib in a tangential manner and shattered approximately 10 cm. of the posterior and lateral aspect of the fifth rib. The serratus anterior muscle was torn and the fifth and sixth intercostal muscles were intact and the periostium of the rib was nearly intact.

Shaw removed more of the fifth rib to enter the chest wall. There was damage of the middle lobe of the right lung due to the impact upon the chest. It actually was ripped into two segments and there was a leak in the bronchus. The lower two thirds of the lower lobe of the right lung looked just like liver "just a bag of blood."

Shaw repaired the right middle lobe. It inflated well. There was not need to touch the lower lobe of the right lung except for a 1 cm. long rent in it. This was oversewn.

Shaw cut off approximately 5 cm. of the anteriorly placed chest tube and placed a posterior tube in the 8th interspace.

There was an obvious rent in the latissimus dorsi muscle. A Penrose drain was placed here.

The wound in the back was shaped as if the bullet had entered at a slight declination. Shaw probed through this wound with his finger and felt the Penrose drain that he had placed in the latissimus dorsi muscle.

In measuring the diagram made by Doctor Shaw at the time of this interview so the better to illustrate the size of the entrance and exit wounds, it is interesting that the entrance wound measurement taken from this diagram are 1.5 x 0.8 cm. with the long dimension in the longitudinal plane of the body (the long axis of the body) and that the exit wound is approximately 5 cm. in greatest dimension.

At the conclusion of the interview Doctor Shaw signed the diagram this was witnessed by Purdy, Flanigan, and Petty, the original copy taken by Purdy.

Although conclusions are not called for, this being merely a report of an interview, it is obvious that Doctor Shaw is describing a wound of the chest which did not pass through the plural cavity but rather was more of a "slapping" wound.

Sincerely yours,



Charles S. Petty, M.D.

CSP:jf  
d

## SELECT COMMITTEE ON ASSASSINATIONS

F-71

NAME Dr. Robert Shaw Date 11-9-77 Time 1:00  
 Address 7403 Villanova Dallas County Institute of  
 Place Forensic Sciences, Dallas

Dallas, Texas 75225 214 691 6136 -- 214 752 3752  
 Date of Birth: 11/15/05  
 Interview:

Dr. Shaw arrived at the trauma room in which Governor Connally was being treated five minutes past his arrival. The residents (Drs. Boland, Duke, Giesecke) had done an excellent job.

The Governor's front chest had 5 cm. (obvious) wound of exit - paradoxical motions of chest were evident. There was a smaller tunneling wound in the back/chest. The bullet struck the 5th rib in a tangential way pushing it out, causing a fracture at a point farther up the rib (like a tree limb breaking from pressure exerted near its end). Bullet and rib fragments exited out the front of the Governor causing the larger exit hole.

Shaw said the lower 2/3ds of the Governor's lower lung lobe was like liver, full of blood and holes caused by secondary (bone) missile fragments. There was a rent in the latissimus dorsi.

The rear entrance wound was not 3 cm as indicated in one of the operative notes. It was a puncture-type wound, as if

(continued)  
 Interviewer Andy Purdy  
 (Signature)  
Andy Purdy  
 (Typed)

Date Transcribed 11/17/77 by LI  
 (I)

a bullet had struck the body at a slight declination (i.e. not at a right angle). The wound was actually approximately  $1\frac{1}{2}$  cm. The ragged edges of the wound were surgically cut away, effectively enlarging it to approximately 3 cm.

Wrist: The wrist wound had been described as a "comminuted" fracture, meaning (according to Dr. Shaw) it was "compounded" (I.E. in more than two pieces). The work on the wrist was primarily done by Dr. Gregory (deceased).

Dr. Shires did the work on the thigh wound.

In response to Dr. Petty's questions, Dr. Shaw provided the following:

- 1) The bullet entering the back did not strike dead on, hitting instead on a decline.
- 2) The entrance wound was olvode (see Dr. Shaw's drawing attached).
- 3) The shape of the entrance wound was consistent with a missile striking in a slightly downward trajectory. It is Dr. Shaw's opinion that the wound was not caused by a tumbling bullet (an inference drawn, explicitly, from his belief that a tumbling bullet would not have had sufficient force to cause the remainder of the Governor's wounds).
- 4) Dr. Shaw believes that the bullet which hit the Governor had not struck any other objects because of his conclusion that the bullet was not tumbling.



He does note that the entrance wound was longer along the vertical axis.

- 5) The bullet did not traverse the thorax; it was essentially "...a chest wall wound ...," with much of the damage to the Governor being caused by a "blast-like" effect which resulted from the bullet tangentially striking the fifth rib, turning pieces of it into secondary missiles.
- 6) He described the chest wound as a "slap wound" exerting an inward force on the body from the secondary fragments.
- 7) The blood found in the lung's lower lobe was from a tear in the middle lobe and contusion from the slapping effect of the bullet, as well as from the penetration of multiple rib fragments ("...it was very much like a blast injury ...").
- 8) The bullet did not traverse the lung; there was essentially a chest wall injury which involved the lung because of a blast injury effect ("...there was a bronchial tear in the middle lobe in addition to the rent...").

Dr. Shaw examined the original Connally X-rays and the enhanced copies. He could not detect any metal fragments in the chest or in the femur (thigh bone). The only metal fragment he denoted was a small one in the subcutaneous tissue in

in the thigh. He did notice the rib fracture in the chest X-ray, as well as rib pieces.

Dr. Shaw indicated that the enhanced X-ray of the fragment in the thigh convinced him that the object was metal because it has greater density than bone and the existence of a hook-like end of the object is more consistent with metallic than with bone characteristics.

Regarding press accounts that he felt the metal fragment was too heavy to have come from C.E.399, Dr. Shaw said he is not qualified to speculate as to the actual size or weight of the fragment in the thigh or those in the wrist (even though he admittedly did so before the Warren Commission 4 H 113). He did say he has never been satisfied that the bullet found on Governor Connally's stretcher had caused all of the Governor's wounds.

Shaw believes the "...bullet found on the limousine floor was more likely the one which went through Connally." He believes the bullet that went through the President's neck may have gotten caught in the Governor's clothing and another bullet struck the Governor causing his wounds.

Regarding the wrist wound, Shaw said he first thought the bullet entered through the volar aspect and exited the dorsum; he was later convinced by Dr. Gregory (and currently believes) that the exact opposite was the case.







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February 2, 1978

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Doctor Shaw appeared to be a very healthy, enthusiastic man whose powers of recollection are excellent, although some of the observations that he related were obviously somewhat stereotype because of many previous interviews regarding the subject at hand. To a very marked degree the information and answers given by Doctor Shaw were similar to those reported in the article published in volume 60, January 1964 of the Texas State Journal of Medicine.

I shall attempt to condense what Doctor Shaw related to me at the time of the interview for ease of reading. I will put the report in the form of a series of very small paragraphs. You already have the original diagram made by Doctor Shaw illustrating the point of entrance and exit of the bullet in J.B.C. and also showing to the best of his recollection the actual size of both the entrance and exit wounds.

J.B.C. was lying on his back when first seen by Shaw. A 5 cm. greatest dimension wound was present just below the right nipple. It was irregular in shape, sucking and there was paradoxical motion noted.

Lateral to the scapula on the right posterior thoracic wall was a small wound.

Doctor Shaw debriefed the anterior wound.

There was a tunnel made by the missile in passing through the chest wall.

The bullet struck the fifth rib in a tangential manner and shattered approximately 10 cm. of the posterior and lateral aspect of the fifth rib. The serratus anterior muscle was torn and the fifth and sixth intercostal muscles were intact and the periostium of the rib was nearly intact.

Shaw removed more of the fifth rib to enter the chest wall. There was damage of the middle lobe of the right lung due to the impact upon the chest. It actually was ripped into two segments and there was a leak in the bronchus. The lower two thirds of the lower lobe of the right lung looked just like liver "just a bag of blood."

Shaw repaired the right middle lobe. It inflated well. There was not need to touch the lower lobe of the right lung except for a 1 cm. long rent in it. This was oversewn.

Shaw cut off approximately 5 cm. of the anteriorly placed chest tube and placed a posterior tube in the 8th interspace.

There was an obvious rent in the latissimus dorsi muscle. A Penrose drain was placed here.

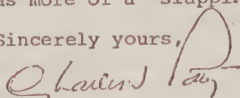
The wound in the back was shaped as if the bullet had entered at a slight declination. Shaw probed through this wound with his finger and felt the Penrose drain that he had placed in the latissimus dorsi muscle.

In measuring the diagram made by Doctor Shaw at the time of this interview so the better to illustrate the size of the entrance and exit wounds, it is interesting that the entrance wound measurement taken from this diagram are 1.5 x 0.8 cm. with the long dimension in the longitudinal plane of the body (the long axis of the body) and that the exit wound is approximately 5 cm. in greatest dimension.

At the conclusion of the interview Doctor Shaw signed the diagram this was witnessed by Purdy, Flanigan, and Petty, the original copy taken by Purdy.

Although conclusions are not called for, this being merely a report of an interview, it is obvious that Doctor Shaw is describing a wound of the chest which did not pass through the plural cavity but rather was more of a "slapping" wound.

Sincerely yours,



Charles S. Petty, M.D.

KENNEDY

005009

INVESTIGATION INTERVIEW SCHEDULEIdentifying Information:Name Dr. George Thomas ShiresDate 1/9/78

Address \_\_\_\_\_

Place New York Hospital - Rm. F739

City/State \_\_\_\_\_

East 74th StreetNew York City

Telephone \_\_\_\_\_

Date of Birth \_\_\_\_\_

M or S \_\_\_\_\_

Social Security \_\_\_\_\_

Spouse \_\_\_\_\_

Children \_\_\_\_\_

Physical Description:

Height \_\_\_\_\_

Color Eyes \_\_\_\_\_ Hair \_\_\_\_\_

Weight \_\_\_\_\_

Special Characteristics \_\_\_\_\_

Ethnic Group \_\_\_\_\_

Personal History:a. Present Employment: Cornell Medical SchoolAddress New York, New York

Telephone \_\_\_\_\_

b. Criminal Record

1. Arrests \_\_\_\_\_

2. Convictions \_\_\_\_\_

Additional Personal Information:

a. Relative(s): Name \_\_\_\_\_

Address \_\_\_\_\_

b. Area frequented: \_\_\_\_\_

c. Remarks: \_\_\_\_\_

Investigator

Andy RudyMark Flanagan



KENNEDY

## SELECT COMMITTEE ON ASSASSINATIONS

NAME Dr. George Thomas Shires Date 1/9/78 Time 11:40 a.m.  
 Address \_\_\_\_\_ Place New York Hospital  
East 70th Street  
New York City  
Room F739

## Interview:

Dr. Shires was interviewed by Mark Flanagan and Andy Purdy, with assistance from medical consultant Dr. Michael Baden.

Dr. Shires initially recapped the events leading up to and comprising the medical treatment of Gov. John Connally. Dr. Shires said Dr. Shaw was a thoracic surgeon, so he worked on the wound to the torso; Dr. Gregory was an orthopedist, so he worked on the wrist; and Dr. Shires worked on the thigh wound. Dr. Shires arrived after the other work had already begun, coming from a Western Surgical Association meeting in Galveston, Texas.

Dr. Shires said his work on the thigh was "...largely an exploration to insure that there was no vessel damage." Dr. Shires said the only significant wound in the thigh was a missile tract. He says he merely did a debridement. When asked if the thigh wound could have been caused by a secondary fragment, Dr. Shires said you "...can't tell anything from the size or shape of the wounds as to whether or not it is an entrance or exit wound." He said that when dealing with fragments, there are many unknowns and variables and that it's hard to differentiate fact from fiction.

Interviewer \_\_\_\_\_

(Signature)

A. Purdy/M. Flanagan

(Name)

Date Transcribed 1/24/78by am  
(Tr)

Dr. Shires said the wound was small and that the thigh had very little damage and did contain a metal fragment. Dr. Shires was asked about his Warren Commission testimony that noted a peculiarity in the nature of the wound; namely, that the tissue damage seemed more significant than the size of the fragment present. He said that it is difficult to determine how the fragment entered. He said "...all you can say is that a tangential wound occurred." He said that there are a large range of possibilities for what happened. Significantly, Dr. Shires said the main issue he was seeking to resolve by the examination of the thigh was whether the missile could have hit a major vessel. He said it did not, and that he did not physically pursue the fragment that was there because it was "...not medically significant." Dr. Shires said he was able to determine that the fragment was in the thigh bone from his examination of the original Connally X-rays.

At this time, we showed Dr. Shires the three original thigh X-rays and the enhancements of these X-rays. Dr. Shires said that it doesn't make any difference whether the metal fragment is in the femur or just under the skin with regard to the issue of whether there was a full bullet striking the thigh or a fragment of a bullet. He said the wounds were probably caused by a tangential hit. He said a tangential wound could have sent the fragment anywhere into the thigh. Dr. Shires noted that on the enhancement of the thigh the

item in the bone looks more like an artifact than when he examined the original. He was open-minded about the possibility that the fragment could have been just under the skin, but preferred to reiterate his initial impressions that the fragment was in the thigh bone. Dr. Shires said that while they explored the entire track of the missile, they were not "...exploring it as a track..."; rather they were "...exploring the wound looking for a big missile injury." Dr. Shires said he found little hemorrhage, so he felt it was likely that a high velocity missile did not pass through the skin causing the wound.

Dr. Shires' recollections of the treatment conducted and the nature of the thigh wound was then tape-recorded.



## TRANSCRIPT OF INTERVIEW OF DR. G. THOMAS SHIRES

Introduction to tape:

DATE: January 9, 1978

TIME: 3:55 P.M.

PLACE: Dr. G. Thomas Shires' Office  
Cornell Medical School  
New York, New York

Dr. Shires is Chief of Surgery, Cornell Medical School

INTERVIEWERS PRESENT: Donald A. Purdy, Jr., Staff Counsel  
T. Mark Flanagan, Staff Researcher

CONSULTANT: Dr. Michael Baden (also present)

Dr. Shires consented to taping of session.

ABBREVIATION CODE: P - Purdy  
F - Flanagan  
S - Shires  
B - Baden

P: Okay, Dr. Shires, we have just had a general discussion of events leading up and the surgery that you performed on Governor Connally on November 22, 1963, and then had a discussion of the specific nature of the wound to the thigh which you operated on, and you have examined the original X-rays of the thigh wound and enhancements of those X-rays, is that correct?

S: Right.

P: Okay. I want to ask you about the thigh wound. Specifically in your report of November 22, 1963, as I read to you previously, you described the wound as follows:

"There is a one centimeter punctate missile wound over the juncture of the middle and lower third, medial aspect, of the left thigh. X-rays of the thigh and leg reveal the bullet fragment which was embedded in the body of the femur in the distal third."

P: Is that a correct statement of your understanding of the wound in the Governor's thigh, and what the X-rays of that wound reveal?

S: Right.

P: I have here a report of November 29, 1963, prepared by Dr. Jack Reynolds, who was a radiologist at that time, where he also described the thigh wound. He said as follows:

"...There is, however, one density which remains constant on both films and appears to lie beneath the skin in the region of the subcutaneous fat in the medial aspect of the thigh."

He also said that this density lies

"...15.2 centimeters above the distal end of the medial femoral condyle on the AP film and on this film, lies 8 millimeters beneath the external surface of the skin. It is 6.25 centimeters medial to the femoral shaft."

Now, obviously there is a difference in terms of the location of the metal fragment. Do you believe that the metal fragment was in the thigh bone itself or do you believe Dr. Reynolds is correct, saying it's in the region of the subcutaneous fat? Or do you believe it could be either way?

S: I think it could be either way. The wound in the skin was described as a tangential wound, which means that it was larger than a direct entry of the fragment wherever it might be located, would have generally made. Therefore, the tangential nature, the long nature of the wound could have been made by the fragment on a tangent to the skin, then entering subcutaneous or bone, or it could have been made by a larger missile with a fragment coming off and lodging

in subcutaneous tissue or bone. So, I think that it could be either. Medically, the fragment was not sought. Because medically the reason for exploration of the wound was to make certain there was no injury to adjacent structures, primarily artery and vein, and none was seen. No search was made for the fragment as it generally is not, in a wound of this nature where the indication is to determine surrounding injury, so that the fragment could have been either place.

P: Did you have occasion to explore the region between the location where Dr. Reynolds said the fragment was located and the bone itself to see if there was, in fact, damage there?

S: Right. Looking for a vessel or other structure injury.

P: And, as you stated, you did not find any such injury?

S: No.

P: And it is your feeling that that does not necessarily preclude the fact that there could have been some damage there, in other words, that the fragment could have actually been in the bone itself?

S: Right. It could have been damaged. But this is a small fragment and in wounds like this, you never really look for the fragment, you're looking for significant injury that might do subsequent harm. And none was found.

P: In other words, you were not trying to remove that fragment?

S: That's right; that's right. Nor even search for it. You're searching for injury to vital structures, not for



a fragment itself.

P: Does your examination of the enhancements of the Connally X-rays affect, at all, however slight, your impression as to whether or not the metal fragment was located in the bone itself or just under the skin?

S: With the artifacts that are over the bone, I think it's very difficult to tell. On the anterior, correction, on the lateral view, it appears that the most likely defect would appear opposite bone. On the other hand, on the anterior-posterior view, it would appear it could either be bone or subcutaneous tissue. I can't really say with certainty.

P: But, either way, it is your belief that your description of the possible causes of the wound in the thigh are still as plausible as before you considered the possibility of the metal fragment being located just under the skin?

S: Exactly, I think the reason the nature of the wound was described as tangential was that it was too large for a right angle fragment or a right angle bullet to have made this, with no more evidence on X-ray of fragments than there were. So that a bullet could have hit it at an angle and left the wound, leaving the fragment behind, or the fragment could have been at such an angle that it caused a linear tangential wound in the skin and then dived either subcutaneously or in the bone, but I don't think you can preclude either possibility.

- P: So you're saying the wound could have been caused by either that small fragment evident in the X-ray or by a full bullet which deposited that fragment?
- S: Exactly.
- P: What, if anything, can we conclude from the nature of the wound of the thigh about the velocity of the bullet, or the size of the bullet?
- S: Nothing definitive. In general, a high-velocity large wound will have, will leave more evidence of tissue damage. You would conclude that in general this wound showed no evidence of large-mass, high-velocity injury at any depth at all. Again, this can be, this can be in error. For example, extremely high-velocity small calibre injury can leave a tremendous amount of damage. A large calibre low velocity injury can leave a tremendous amount of damage, so there are in the injury spectrum, it's very hard to say from the nature of the wound anything more than it's less likely that there was a large-mass, high-velocity tissue injury, less likely.
- P: And in layman's terms, that means you believe that it is not likely that a high-mass, high-velocity bullet struck this thigh without first being slowed down by hitting something else?
- S: I can't say that. I just don't know. I think it's, from the wound, you can say that it's less likely that a high-velocity, high-mass injury penetrated very far.
- P: I see.

- B: Well, let me just, to recapitulate, is there anything in your review of the original X-rays of the femur which Mr. Purdy brought from Washington today, which you reviewed, the original procedure, inconsistent with the report that Mr. Purdy read to you by Dr. Reynolds?
- S: No, nothing inconsistent.
- B: And, do you have an opinion or do you feel it fair to ask an opinion on the basis of the injury in the thigh and on the basis of what you knew in general about Governor Connally, since you were the chief of service at the time, consistent or inconsistent with the wound in the chest, wrist, and thigh coming from the same missile?
- S: There's nothing inconsistent about that, no.
- B: They could have all happened from the same, a single missile?
- S: They could.
- P: Well, furthermore, can you state that it is likely that those wounds were caused by the same missile?
- S: No.
- P: Okay. And as the middle point between likely and anything not inconsistent with, can you say that it's unlikely that they were caused by the same missile?
- S: Can I say it's unlikely they were caused by the same missile?
- P: All those wounds in Governor Connally.



- S: No. I mean I can't say that either way, because a tangential injury, let's assume that it was not a fragment for a moment, tangential injury could be made by any size, shape or velocity missile, and still leave a fragment and give exactly what was given here, so that I can't say that it's likely or unlikely that that bullet had been somewhere else first.
- P: Did you have the opportunity to sufficiently examine the other wounds of Governor Connally to draw a conclusion as to whether those wounds, as well as the wounds in the thigh, were caused by the same bullet, or was your examination just confined to the thigh wound?
- S: No, mine was just too late for that because the thoracotomy and the exploration of the arm were already underway, so I never really saw an existing wound. What I saw was a surgical wound. Attempt to repair the damage that had been done, so that's why I really, you know, can't give an opinion about it at all.
- F: Well, Dr. Shires, before concluding the tape, do you have anything at all you would like to add, not only pertaining to the medical evidence of Governor Connally, but any other area at all in connection with the investigation of the assassination? Do you have any comments you would like to have (something) to have at this time?
- S: No, nothing that I know of has happened, you know, since the day of the assassination that would have changed our opinion from what we recorded with the attorneys at the time,

in terms of additional knowledge or subsequent developments in the care of the patient or any of that sort of thing. Realizing that our testimony was given I guess several weeks after the episode, a good many days, so that the general patient care, the fact that the Governor got well and so on had already occurred, so we really, I guess, wouldn't expect anything subsequently to have happened that would have changed anything we gave as depositions at that time, when it happened. Maybe a pertinent negative, I don't know. We didn't, we haven't learned anything subsequently that would have changed what we said.

P: Dr. Shires, from the nature of the thigh wound and your examination of the X-rays, do you believe that the metal fragment today would be in pretty much the same location or would it possibly have exited the body?

S: Now?

P: Yes.

S: I have no idea, I really don't. Perhaps you can answer this better than I can.

B: Well, I would just, my impression would be that unless it were taken out in the process of debredment, which Dr. Shires did, it was so small it could be taken out without noticing it.

S: (In background, uhuh). Right; without knowing it.

B: Then it would have stayed in and be there; it wouldn't have worked it's way out, unless there was an infection or something.

S: I agree with that. It may well have been removed in the

course of the exploration because it is a tiny fragment and as I say, medically, what you're looking for is adjacent structure injury, not the fragment itself, so it could well have been, could well have come out as a part of the exploration. If not, I would assume, like you, that it would still be there. You leave fragments all the time in wounds and by and large, and there are notable exceptions, but by and large, they're there forever, for years and years, and cause no difficulty at all. That's one reason we don't chase the fragments so to speak. Now, when infection occurs usually it was carried in at the time of the injury, and came off organisms that were on the clothing or the skin and generally speaking, if there is to be infection and exclude that fragment, it will occur fairly soon. On the other hand, we've seen them years later develop infection around a fragment and exclude it. So it can always happen, many, many years later. But, as far as I know, that's not happened to him and I would assume it was either, came out in debredment, or would still be there on X-ray.

P: Was the exploration of the thigh wound sufficient that if the metal fragment was located in the femur itself, it might have come out during the surgical procedure? Did you explore that far in? (S: Poss..)

S: We weren't looking for the fragment, but again, in an exploration of a wound, it's possible. Because, you know, saying it is in a femur is what, for example, whether this was on the surface or, you really can't tell



because the films weren't made for that purpose. That was not the reason for the X-rays. So it could well have come out as part of the exploration.

B: I think just for the record, while we have the opportunity, if you can mention to the best of your recollection how the track looked when you got into it, how the wound on the skin looked and the track looked as far as..

S: Just very, very minimal damage. Really minimal tissue damage.

B: Not much bleeding?

S: Right. Right.

B: And you explored down to the, looked at the blood vessels...

S: Right.

B: without necessarily seeing a hemorrhagic track?

S: That's right. Minimal damage, which I think we described in there as very minimal.

B: The other point about...

P: If I could ask how large was it? Do you think the one centimeter in your report is an accurate description of how large the wound in the thigh was?

S: That's what I said.

B: That's the depth of the track, Andy?

S: No. The tangential wound.

B: Tangential wound. One centimeter.

S: I described...

B: On the skin surface.

S: Right.

- B: The other thing I thought would be of value is just a brief recollection that we discussed briefly before, about exactly where you were when this happened, how you, the time it took you to get to the operating room?
- S: As to why I got in sort of after the others were in progress?
- B: That's, yes, where you, as chief of service were, and when.
- S: Yeah, the meeting of a national surgical organization, the Western Surgical Association, was meeting in Galveston, as it happened that year. This organization meets in different cities all over the country each year, and after giving a paper at that meeting that morning, I got a telephone call from Dr. Shaw, who's a thoracic surgeon, that operated on the Governor, telling me what had happened, about the President and the Governor, and saying that they were, that they had three areas of injury and they were beginning to operate on the one that was the most pressing, which was the thoracic injury, and hoped I could get back and shortly after that, some calls were made in Galveston and the Air Force actually picked me up and took me back to Dallas. So when I got to the operating room, the first, the President had already, body had already been removed and the two other procedures were well along, the thoracic and the orthopaedic procedure, and then this third procedure was started to make certain there was no significant vessel injury.
- B: The other part about it, would you have any comment for the record, as to your recollection about the forensic

pathological aspects of what happened as far as the removal of the body, and...

S: Not firsthand, it was all resolved, hearsay. In talking to the pathologist, he thought the autopsy should have been done by him there at the time and apparently made his feelings well-known to them.

B: This was the forensic pathologist..

S: There, at the hospital..

B: Who was..., at the hospital..

S: Dr. Reynolds, who really thought that it should be done immediately, and apparently it was decided, superceded and the body was taken to Washington.

P: Any other comments or questions? (Pause)

F: Is everything over now at this time?

P: Yeah. Just...

F: The time is now 4:14. This taping session has been concluded.



## ADDENDUM J

LETTER FROM MICHAEL M. BADEN, M.D., CONCERNING IDENTIFICATION OF THE  
X-RAYS EXAMINED AT THE NATIONAL ARCHIVES, JANUARY 19, 1979

DEPARTMENT OF HEALTH  
OFFICE OF CHIEF MEDICAL EXAMINER  
520 FIRST AVENUE, NEW YORK, N.Y. 10016  
Telephone: 212-684-1800

MICHAEL M. BADEN, M.D., *Chief Medical Examiner*

January 19, 1979

Mark Flanagan, Esq.  
Select Committee on Assassinations  
U.S. House of Representatives  
Washington, D.C. 20515

Dear Mr. Flanagan,

Pursuant to our discussions, a statement should be contained in the Forensic Pathology Panel report concerning the x-rays examined at the National Archives. These x-rays were identified and verified to the Panel by Dr. John Ebersole as the same x-rays that he had taken before and during the autopsy of President John Kennedy; that they show the same findings now as then; and that none are missing, none have been added and none have been altered. Further, the x-rays were independently and individually confirmed by comparison to pre-existing x-rays obtained from the John F. Kennedy Library.

Red adherent numbers were affixed to each x-ray for identification purposes by Dr. Ebersole, which are the numbers referred to below. At the time the x-rays were taken the following Hospital identification marker was used:

21296  
US NAVAL HOSPITAL  
NNMC BETHESDA MD  
F 11 22 63

- 1- Skull: anterior-posterior view
- 2- Skull: right lateral view (Dr. Ebersole advised the Panel that he placed the penciled lines present to obtain anthropomorphic measurements)
- 3- Skull: left lateral view
- 4- } 3 separately received skull bone fragments with
- 5- } no identification marker present
- 6- }
- 7- abdomen: after autopsy was begun
- 8- right chest and arm: after autopsy was begun
- 9- Chest: anterior-posterior view-prior to autopsy
- 10- Left chest and arm: after autopsy was begun; identification marker not present
- 11- lower chest and upper abdomen - after autopsy was begun; identification marker not present
- 12- Knees and thighs
- 13- Pelvis: before autopsy
- 14- Pelvis: after autopsy was begun

Sincerely,

*Michael Baden*

Michael M. Baden, M.D.

NMB:mr

## REFERENCES

- (1) FBI report, DL 100-10461, Warren Commission Document No. 205, pp. 153-154.
- (2) Ibid.
- (3) Letter from J. Edgar Hoover, Director, FBI, to J. Lee Rankin, General Counsel, the President's Commission, Mar. 23, 1964.
- (4) See reference 1, pp. 153-154.
- (5) Ibid.
- (6) Letter from Frank Scott, photographic evidence panel, to House Select Committee on Assassination, June 13, 1978.
- (7) Autopsy protocol, John F. Kennedy, U.S. Naval Medical School, Nov. 22, 1963, A63-272, p. 3 [hereinafter cited as autopsy protocol].
- (8) Autopsy descriptive sheet, U.S. Naval Medical School, A63-272, Nov. 22, 1963.
- (9) See reference 1, pp. 153-154.
- (10) See reference 3.
- (11) *Report on soft X-ray and energy dispersive X-ray analysis of the clothing of John F. Kennedy and John B. Connally*, Southwestern Institute of Forensic Sciences, Dallas, Tex., Charles S. Petty, M.D., director, Feb. 1, 1978 (JFK Document No. 005090), [hereinafter soft X-ray report], see addendum F to this report.
- (12) Autopsy protocol, p. 3.
- (13) Id. at p. 4.
- (14) Testimony of Dr. Malcolm O. Perry, hearings before the President's Commission on the Assassination of President Kennedy, (Washington, D.C.: U.S. Government Printing Office, 1964), Volume III, p. 368, (hereinafter Perry Testimony, III Warren Report, 368).
- (15) Staff interview of Dr. Malcolm O. Perry, Jan. 11, 1978, House Select Committee on Assassinations, p. 1 (JFK Document No. 006370).
- (16) Id. at p. 2.
- (17) Staff interview of Dr. Malcolm O. Perry, Jan. 11, 1978, taped segment, House Select Committee on Assassinations, p. 15 (JFK Document No. 006370).
- (18) The President's Commission on the Assassination of President Kennedy. Commission exhibit No. 392, vol. XVII, p. 4.
- (19) Staff interview of Dr. C. James Carrico, Jan. 11, 1978, House Select Committee on Assassinations, p. 3 (JFK Document No. 005003).
- (20) Ibid.
- (21) Testimony of Dr. James J. Humes, hearings before the President's Commission on the Assassination of President Kennedy, (Washington, D.C.: U.S. Government Printing Office, 1964), volume II, p. 363 (hereinafter Humes testimony, II Warren Report 363).
- (22) Staff interview of Dr. William B. Seaman, Feb. 27, 1978, House Select Committee on Assassinations, p. 2 (JFK Document No. 006132).
- (23) Autopsy protocol, pp. 4-5.
- (24) Id. at p. 5.
- (25) Ibid.
- (26) Letter and notes from Pierre A. Finck, M.D., USA, Chief, Military Environmental Pathology Division and Chief, Wound Ballistics Pathology Branch, Armed Forces Institute of Pathology, to Brig. Gen. J. M. Blumberg, MC, USA, Director, Armed Forces Institutes of Pathology, Feb. 1, 1965, regarding personal notes on the assassination of President Kennedy, p. 3 (JFK Document No. 006165).
- (27) Autopsy protocol, p. 6.
- (28) See reference 17, p. 7.
- (29) Id. at pp. 6-7.
- (30) Id. at p. 9.
- (31) Ibid.
- (32) Testimony of Pierre A. Finck, M.D., Criminal District Court, Parish of Orleans, State of Louisiana, *State of Louisiana v. Clay L. Shaw*, afternoon session, Feb. 24, 1969, vol. II, p. 118-119 (JFK Document No. 002036).
- (33) Autopsy protocol, p. 4.
- (34) Ibid.
- (35) See reference 26, p. 2.
- (36) Autopsy protocol, p. 4.
- (37) See reference 26, p. 2.

- (38) Memorandum from J. Laurence Angel to JFK Skull Review Committee, Oct. 24, 1977, p. 2 (see addendum E to this report).
- (39) *Id.* at p. 3.
- (40) Dissenting view to forensic pathology panel report, Cyril H. Wecht, M.D., J. D., Oct. 23, 1978, p. 4 (see part VI to this report.)
- (41) *Ibid.*
- (42) Statement by Dr. G. M. McDonnel to House Select Committee on Assassinations, Mar. 8, 1978, enclosure No. 1.
- (43) Memorandum from Dr. David O. Davis, professor and chairman, department of radiology, George Washington University Hospital, to T. Mark Flanagan, House Select Committee on Assassinations staff member, Aug. 23, 1978, p. 3. (JFK Document No. 010958).
- (44) Autopsy protocol, p. 4.
- (45) *Ibid.*
- (46) Supplementary report of autopsy No. A63-272, President John F. Kennedy, Dec. 6, 1963, p. 1 [hereinafter supplementary report].
- (47) Autopsy protocol, p. 4; supplementary report, p. 1; Humes testimony, II Warren report 355-356.
- (48) Supplementary report, p. 1.
- (49) *Id.* at p. 2.
- (50) Autopsy protocol, p. 6.
- (51) See reference 26, p. 2.
- (52) Autopsy protocol, p. 3.
- (53) Memorandum pursuant to a Department of Justice request to examine the X-rays and photographs to determine whether they are consistent with the autopsy report, from James J. Humes, M.D., J. Thornton Boswell, M.D., and Pierre A. Finck, M.D., Jan. 26, 1967, p. 5. (Note: This is a blank letterhead memorandum.)
- (54) Autopsy protocol, p. 5.
- (55) Supplementary report, p. 2.
- (56) Letter from J. Edgar Hoover, Director, FBI, to J. Lee Rankin, General Counsel, the President's Commission, Apr. 16, 1964, Warren Commission No. 827.
- (57) See Reference 11, pp. 6-7.
- (58) Parkland Memorial Hospital operative record, John B. Connally, surgeon: Robert Shaw, M.D., Nov. 22, 1963, p. 1.
- (59) Staff interview of Dr. Robert R. Shaw, House Select Committee on Assassinations, Nov. 9, 1977, pp. 2-3.
- (60) Memorandum from Michael M. Baden, M.D. to Gary Cornwell, Esq., Sept. 6, 1978, regarding the physical examination of Governor John Connally, p. 1.
- (61) See Reference 58, p. 1.
- (62) See Reference 60, p. 2.
- (63) Parkland Memorial Hospital, report of diagnostic X-ray consultation, Connally, John G., Nov. 22, 1963, J. Reynolds, M.D., reporting physician.
- (64) *Ibid.*
- (65) See Reference 58, pp. 1-2.
- (66) Staff interview of Robert R. Shaw, M.D., House Select Committee on Assassinations, Nov. 9, 1977, p. 1.
- (67) Letter from Charles S. Petty, M.D., director, Southwestern Institute of Forensic Sciences, Dallas, Tex., to Donald A. Purdy, Jr., staff counsel, House Select Committee on Assassinations, Feb. 2, 1978, p. 2 (JFK Document No. 005095).
- (68) See Reference 60, p. 2.
- (69) Parkland Memorial Hospital operative record. Gov. John Connally, surgeon: Dr. Charles Gregory, Nov. 22, 1963, p. 1.
- (70) Parkland Memorial Hospital surgical pathology report, Connally, John G., lab. No. S63-6750, Nov. 25, 1963, pathologist: Vernie A. Stembridge, M.D.
- (71) See Reference 69, p. 1.
- (72) *Id.* at p. 1.
- (73) See Reference 70.
- (74) See Reference 60, p. 2.
- (75) Parkland Memorial Hospital, report of diagnostic X-ray consultation, Nov. 22, 1963.
- (76) FBI report, Nov. 30, 1963, file DL 89-43, Special Agent J. Doyle Williams.
- (77) FBI report, Nov. 23, 1963, file DL 89-43, Special Agent J. Doyle Williams.



- (78) Parkland Memorial Hospital operative record, Connally, John B. [sic], Surgeon: Dr. Shires, Nov. 22, 1963.
- (79) See Reference 70.
- (80) Staff interview of Dr. George Thomas Shires, House Select Committee on Assassinations, Jan. 9, 1978, pp. 1-2 (JFK Document No. 005009).
- (81) Id. at pp. 2-3.
- (82) Parkland Memorial Hospital, report on diagnostic X-ray consultation, Nov. 22, 1963.
- (83) Supplementary report of films of Gov. John G. Connally, dated Nov. 22, 1963, Parkland Memorial Hospital, Jack Reynolds, M.D., Nov. 29, 1963.
- (84) X-ray back scatter with scanning electron microscopy and energy dispersive X-ray of tissues of J. B. C., Southwestern Institute of Forensic Sciences at Dallas, Charles S. Petty, M.D., director, Aug. 29, 1978, p. 1 (JFK Document No. 011167).
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- (88) Nichols, John (personal communication to committee, 1978).
- (89) Supplementary report, p. 1.
- (90) Sherrington, C. S. "Experiments in Examination of the Peripheral Distribution of the Fibers of the Posterior Roots of some Spinal Nerves." Philos. Trans., 1898, 190B, 45-186 (introduces the term "decerebrate rigidity").
- (91) Testimony of Cyril H. Wecht, M.D., J.D., Sept. 7, 1978, hearings before the House Select Committee on Assassinations, 95th Congress, 2d sess. (Washington, D.C.: U.S. Government Printing Office, 1979), vol. I, p. 347.
- (92) See Reference 53, p. 1.
- (93) Ibid.
- (94) Clinical record, authorization for post-mortem examination, U.S. Naval Hospital, Bethesda, Md., Nov. 22, 1963.
- (95) Ibid.
- (96) See Reference 53, p. 1.
- (97) Humes testimony, II Warren report 348.
- (98) Ibid.
- (99) Id. at p. 349.
- (100) Vernon's Ann. Tex. Statutes, Code of Crim. Proc., Art. 49.
- (101) Id. at Art. 49.01.
- (102) Ibid.
- (103) Ibid.
- (104) Ibid.
- (105) Id. at Art. 49.03.
- (106) Record of Inquest, Dallas County, Tex., Nov. 22, 1963.
- (107) Ibid.
- (108) Ibid.
- (109) Ibid.
- (110) Tex. Crim. Pro. Code Ann. tit. , art. 49.03 (Vernon).
- (111) Certificate of Death, Dallas County, Dallas, Tex., Dec. 6, 1963, Theran Ward, Justice of the Peace.
- (112) See reference 97, p. 348.
- (113) Ibid.
- (114) Ibid.
- (115) See reference 26, p. 17.
- (116) See reference 32, pp. 117-118.
- (117) See reference 26, p. 17.
- (118) Id. at p. 3.
- (119) Id. at p. 4.
- (120) Id. at p. 17.
- (121) 18 U.S.C.A. § 1751 (1965) (West).
- (122) 18 U.S.C.A. § 351 (1971) (West).



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REPORT OF THE  
FIREARMS PANEL

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Select Committee on Assassinations  
U.S. House of Representatives  
Ninety-fifth Congress  
Second Session

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March 1979

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## INTRODUCTION\*

(1) From the outset, the Kennedy assassination task force of the Select Committee on Assassinations believed that a complete scientific examination of all firearms evidence\*\* was essential to its investigation. The committee wanted to address the many questions that had arisen over the last 15 years about the firearms and firearms identification in the cases of President Kennedy, Dallas Police Officer J. D. Tippit, and Lee Harvey Oswald. The primary concern was to conduct a thorough examination of all the evidence, though some items, such as Jack Ruby's revolver, were less relevant. The committee chose this approach in part to see if any new investigative leads would develop.

### *Background*

(2) Within an hour after President Kennedy was shot at approximately 1:12 p.m. central standard time (CST) (1) on November 22, 1963, Deputy Sheriff Luke Mooney discovered three expended cartridge cases on the floor near a window at the southeast corner of the sixth floor of the Texas School Book Depository. (2) The cartridge cases were turned over to the FBI on November 23, 1963. (3)

(3) At 1:22 p.m., (4) Deputy Sheriff Eugene Boone and Deputy Constable Seymour Weitzman discovered a bolt-action rifle equipped with a telescopic sight, also on the floor of the sixth floor of the book depository, but near the northwest corner. (5) Neither handled the rifle, but at the time Weitzman described it as a 7.65-millimeter caliber German Mauser. (6) (It was subsequently determined to be a 6.5-millimeter caliber Mannlicher-Carcano Italian military rifle. (7)) It was removed from the depository by Lieutenant Day and remained in his possession until it was released to the FBI at 11:45 p.m., November 22, 1963. (8)

(4) When found, the Mannlicher-Carcano contained one unfired 6.5-millimeter caliber copper-jacketed, military-type cartridge, manufactured by the Western Cartridge Co. The cartridge was removed from the rifle by Capt. J. Will Fritz where the rifle was found. (9)

(5) Later that day, the rifle's six-round cartridge clip was removed by Lieutenant Day in the Dallas Police Crime Laboratory. (10)

(6) While the officers were collecting evidence in the book depository, Officer J. D. Tippit was shot and killed in the Oak Cliff section of Dallas several miles away. (11) Four expended .38 special caliber cartridge cases were found at the scene of the murder. (12) Two of the recovered cartridge cases were manufactured by the Western Cartridge Co., the other two by Remington-Peters. (13) All four were delivered to the FBI laboratory on November 30, 1963. (14) Four .38

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\*Materials submitted for this report by the firearms panel were compiled by HSCA staff members Jim Conzelman and Whitney Watriss.

\*\*A glossary of technical terms can be found at the end of this report.

special caliber bullets were later removed from Tippit's body during his autopsy. They were given to the FBI laboratory on March 16, 1964.(15)

(7) Lee Harvey Oswald was arrested as a suspect in the Tippit shooting shortly before 2 p.m.,(16) November 22. Apprehended after a scuffle in the Texas theater, he was carrying a Smith and Wesson revolver modified to fire .38 special caliber ammunition.(17) Four cartridges were found in the cylinder of the revolver and turned over to the FBI laboratory by the Dallas police on November 30, 1963.(18) Two cartridges were found to be of Western Cartridge Co. manufacture, two of Remington-Peters.(19) Five Western .38 special caliber cartridges were found in Oswald's trouser pocket and also were given to the FBI laboratory by the Dallas police on November 30, 1963.(20)

(8) At approximately 1:55 p.m.(21) on November 22, a virtually intact bullet was found on a stretcher in the emergency area of Parkland Memorial Hospital by Nathan Burgess Pool, an employee of Otis Elevator Co., and D. C. Tomlinson, power plant engineer of Parkland Hospital.(22) Tomlinson handed the bullet to a Secret Service agent standing by the door to the emergency entrance.(23) The bullet was delivered to the FBI laboratory in Washington, D.C., that same day.(24) The Warren Commission eventually designated this bullet Commission exhibit 399 (CE 399), and concluded that it had caused all of Governor Connally's wounds after passing through the President's neck.(25)

(9) Other items of evidence were later recovered. Four lead-like fragments were removed from Governor Connally's wrist (26) and delivered to the FBI laboratory on November 23, 1963.(27) During the President's autopsy at Bethesda Naval Hospital, three fragments were removed from his brain; (28) they were subsequently delivered to the FBI laboratory on November 23, 1963.(29) Four more fragments were recovered from the Presidential limousine: the nose portion of a metal-jacketed bullet, found on the right side of the front seat by the Secret Service; (30) the base portion of a metal-jacketed bullet, found on the floor next to the right front seat by the Secret Service; (31) two lead-like fragments found on the rug underneath the left jump seat by the FBI; (32) and lead residue taken from the inside of the windshield by the FBI.(33) This evidence was turned over to the FBI laboratory for analysis on November 22, 1963.(34)

(10) In addition to these other items, the Warren Commission obtained the bullet recovered by the Dallas police after an attempted assault on General Walker in Dallas on April 10, 1963.(35) It was delivered to the FBI laboratory on December 4, 1963, for analysis.(36) Although the Commission concluded that Oswald fired the bullet, the FBI laboratory could not conclusively identify it with the Mannlicher-Carcano rifle.

(11) An item of evidence that the Warren Commission did not consider was the .38 special caliber Colt Cobra revolver recovered from Jack Ruby at the time of his apprehension in the basement of the Dallas Police Department by Detective L. C. Graves.(37) The revolver had never been sent to the FBI laboratory, but had remained in the possession of Dallas District Attorney Henry Wade, pending



Jack Ruby's trial. (38) At the conclusion of the trial, the revolver was given to the administrator of Jack Ruby's estate, Jules Mayer, (39) from whom the select committee obtained it.

(12) The whereabouts of the expended cartridge case found in the Ruby revolver and the bullet removed from Lee Harvey Oswald at his autopsy are unknown. According to William Alexander, assistant district attorney for the city of Dallas, the cartridge case and bullet were presented as evidence at Jack Ruby's trial; their disposition by the court is unknown. (40) The committee contacted the Dallas Police Department and Jules Mayer to locate them, but to no avail.

(13) The Warren Commission relied on FBI facilities for the firearms identification. (41) It concluded from the FBI tests that the stretcher bullet and the larger fragments of the base and nose of the bullet found in the limousine had been fired from the Mannlicher-Carcano rifle recovered from the Texas School Book Depository. (42) The remaining fragments removed from the limousine, Governor Connally's arm and President Kennedy's brain were too minute for any type of microscopical examination. Spectrographic and neutron activation analysis were conducted on all fragments, allowing their elemental composition to be compared. Although they were found to be of similar metallic composition, (43) the FBI laboratory was unable to determine whether the nose and base fragments originated from the same or different bullets. (44) The firearms examination also revealed that the three expended cartridge cases found in the book depository had been fired in the Mannlicher-Carcano rifle. (45)

(14) Regarding the bullet fired at General Walker, the FBI was unable to identify it with the rifle found on the sixth floor of the depository due to its mutilated condition, (46) although it had the same physical characteristics as the bullet of the cartridge found in the chamber of the Mannlicher-Carcano rifle and other Mannlicher-Carcano ammunition. (47)

(15) Regarding the evidence from the Tippit shooting, the bullets removed from the officer's body could not be positively identified with Oswald's revolver. (48) The FBI firearm experts found that the characteristics engraved on the bullets fired by the revolver were erratic. (49) The FBI experts were unable to identify a correspondence among their own test-fired bullets, even though they were documented as being fired from the same revolver. (50) The cartridge cases found near Tippit's body were, however, identified as having been fired in Oswald's revolver. (51)

(16) All exhibits, with the exception of the items relating to the Oswald shooting death, were given to the National Archives, from which the select committee obtained them.

(17) Two additional items, unavailable to the Warren Commission, were considered by the committee as possibly relevant to its inquiry. The first was a bullet fragment found in 1974 near the triple overpass in Dealey Plaza by Richard Lester. (52) Lester turned it over to the FBI on December 1, 1976, requesting that an analysis be conducted to determine if it might be connected with the assassination. (53) The FBI laboratory obtained from the National Archives the bullets test-fired in the Mannlicher-Carcano rifle in 1963, and on July 28, 1977,

examined the bullet fragment and compared it to the Mannlicher-Carcano test-fired bullets.(54) The laboratory determined that both the Lester bullet and the test-fired bullets were 6.5 millimeter caliber, but the Lester bullet was found to be a jacketed, softpoint or jacketed, hollow-point sporting bullet, whereas the Mannlicher-Carcano bullet was to be a full metal-jacketed, military-type. Although the rifling impressions were similar, four lands and grooves, right twist, the widths of the land and groove impressions were found to vary by about 0.01 inch. The individual identifying characteristics were found to be different. Thus, the laboratory concluded that there was no indication the Lester bullet had been fired from the Mannlicher-Carcano rifle.(55) The laboratory returned the test-fired bullets to the Archives(56) and the fragment to Lester at the completion of its examination.(57) The select committee obtained the bullet from Lester on November 10, 1977.(58)

(18) The second item of evidence was a bullet fragment found in 1967 by Rich Haythorne, who was working as a roofer on top of the Massey Roofing Co. building in the 1200 block of Elm Street, about eight blocks from the Texas School Book Depository(59) (the building is no longer there). It had remained in the possession of Haythorne's attorney, Bill Mason, until he sent it to the committee on April 20, 1977.(60)

(19) Critics of the Warren Commission have used the firearms evidence to cast doubt on its conclusions. Illustrative of the issues that have been raised are the following:

(20) Edward J. Epstein, in "Inquest", contends that more bullet fragments were found in Governor Connally's body than could have been left by the CE-399 bullet that the Commission concluded caused all his wounds.(61)

(21) Mark Lane, in "Rush to Judgment," and others claim that the CE-399 bullet could not have remained virtually intact after causing the Governor's many severe wounds.(62)

(22) In "They've Killed the President," Robert Sam Anson contends that the telescopic sight on the Mannlicher-Carcano rifle was mounted for a left-handed person.(63) Since Oswald is right-handed, it is doubtful that he could have fired the shots in the requisite amount of time.(64)

(23) Sylvia Meagher, in "Accessories After the Fact," questioned Oswald's ability to fire the Mannlicher-Carcano accurately because of the rifle's "hair trigger."(65) She cited the testimony before the Warren Commission of Ronald Simmons of the Ballistics Research Laboratory, Department of the Army, that it was difficult for experts when test-firing the rifle to become accustomed to the drag in the trigger.(66)

(24) Josiah Thompson, in "Six Seconds in Dallas," questioned whether the cartridge cases recovered on the sixth floor of the depository were in fact fired in the Mannlicher-Carcano.(67) He alleged that two of the cartridge cases had markings indicating that they had been loaded into a weapon at least twice—and not necessarily into the Mannlicher-Carcano. He further claimed that the third cartridge case was dented such that it could never have been fired in any rifle.(68)



(25) Finally, some critics, including Mark Lane, were suspicious because of Weitzman's initial misidentification of the Mannlicher-Carcano rifle as a 7.65-millimeter caliber German Mauser. (69)

(26) In light of the criticisms of the Warren Commission's treatment of the firearms evidence, such as those mentioned above, and as part of its obligation to investigate fully the events surrounding President Kennedy's assassination, the select committee decided to convene a panel of experts to reexamine the firearms evidence.

### *Selection of the Panel*

(27) In April 1977, the select committee sought recommendations for membership for the panel from the Association of Firearm and Tool Mark Examiners, the Forensic Science Foundation and the American Academy of Forensic Sciences. Candidates were to be leading firearms experts who had had no prior affiliation with either the King or the Kennedy assassination cases.\*

(29) A list of 27 experts was proposed. Five were eliminated initially: three were current or past employees of the FBI; one had authored material on the firearms evidence; and one was unable to undertake the project.

(30) The remaining 22 prospects were asked to submit resumes, with information on past affiliations with the case and opinions about the assassination or the firearms evidence. Eighteen responded, 10 of whom did not want to be considered or did not meet the committee's criteria.

(31) The following five experts were chosen to serve on the panel:

(32) *John S. Bates, Jr.*—Senior firearms examiner in the New York State Police Laboratory at Albany. He has been a lecturer at the New York State Police Academy, New York State Municipal Police Training Council, and various community colleges.

(33) Bates is a member of the Association of Firearm and Tool Mark Examiners, serving as secretary since 1973. In that year, he received the association's Distinguished Member Award. He has written numerous professional articles.

(34) *Donald E. Champagne*.—Firearm and tool mark examiner with the Florida Department of Criminal Law Enforcement in Tallahassee for the past 10 years. He served in the crime detection laboratory of the Royal Canadian Mounted Police in Ottawa, Ontario, for 15 years, and he has lectured extensively at the Canadian Police College and other law enforcement agencies.

(35) Champagne is president and a distinguished member of the Association of Firearm and Tool Mark Examiners. He is a member of the Southern Association of Forensic Scientists and the Canadian Society of Forensic Science.

(36) *Monty C. Lutz*.—Firearm and tool mark analyst with the Wisconsin Regional Crime Laboratory in New Berlin. He has been the chief firearm and tool mark examiner for the U.S. Army.

(37) Lutz is a past president of the Association of Firearm and Tool Mark Examiners. He has been named a distinguished member of the

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\*The same panel members were also to examine the firearms evidence in the King assassination case.



association. He has lectured at colleges and law enforcement schools across the country and is the author of numerous professional publications. He received a B.S. in criminal justice from the University of Nebraska.

(38) *Andrew M. Newquist*.—Special agent and firearm, tool mark and latent fingerprint examiner for the Iowa Bureau of Criminal Investigation.

(39) Newquist is a distinguished member and past president of the Association of Firearm and Tool Mark Examiners and currently serves on its executive committee. He is a member of the International Association for Identification and a lecturer at the Iowa Department of Public Safety.

(40) The panel conducted its examination at the facilities of the Metropolitan Police Department firearm identification section, Washington, D.C. Assigned as liaison to the panel and working closely with it as technical assistant was George R. Wilson, senior firearms examiner, Metropolitan Police Department, Washington, D.C., a position he has held for 9 years. The laboratory, which he established, was the first in the department's history.

(41) Wilson is second vice president of the Association of Firearm and Tool Mark Examiners. In 1974, he received the association's Distinguished Member Award. During his 25-year tenure with the Metropolitan Police Department, he has been awarded over 30 commendations for outstanding and meritorious performance of duty.

(42) Photographic services were provided by police photographer Gary R. Phillips of the Metropolitan Police Department's photographic services section.

#### *The issues addressed*

(43) The panel was asked to address a number of issues concerning three categories of firearms evidence:

(44) —That relating to the shooting of President Kennedy and Governor Connally, which includes the Walker bullet and the bullet found in 1974 by Richard Lester;

(45) —That relating to the shooting of Tippit; and

(46) —The Ruby revolver (the bullet that killed Oswald and the expended cartridge case were not located).

The issues were as follows: In the Kennedy case:

(47) —Was the cartridge reportedly found in the Mannlicher-Carcano rifle in fact loaded into that rifle?

(48) —From which direction was the impact which damaged the windshield of the Presidential limousine?

(49) —Were the three expended cartridge cases found on the sixth floor of the Texas School Book Depository fired in the Mannlicher Carcano rifle?

(50) —Was the bullet found at Parkland Hospital fired from the Mannlicher-Carcano rifle?

(51) —Was the bullet nose portion found on the right side of the front seat of the Presidential limousine fired from the Mannlicher Carcano rifle?

(52) —Was the bullet base portion found on the floor beside the right front seat of the Presidential limousine fired from the Mannlicher-Carcano rifle?

- (53) —Were the bullet nose portion and the bullet base portion found in the Presidential limousine components of the same bullet?
- (54) —Was the bullet recovered from the residence of General Walker fired from the Mannlicher-Carcano rifle?
- (55) —What are the nature and characteristics of the 6.5 millimeter caliber Mannlicher-Carcano rifle and ammunition with respect to power and impact?
- (56) —Could the Mannlicher-Carcano rifle have been fired with a high degree of accuracy even though it has been described as having a "hair trigger"?
- (57) —Would the dent on the mouth of one of the three expended cartridge cases found on the sixth floor of the Texas School Book Depository prevent the bullet from being fired in the Mannlicher-Carcano rifle, or any other rifle? Can it be determined whether these cartridge cases had been chambered on more than one occasion?
- (58) —Does the method of mounting a scope on a rifle affect or have any influence on whether the rifle can be fired by a left-handed individual?
- (59) —The Warren Commisison found that the stretcher bullet weighed 158.6 grains when recovered and assumed its original weight before firing to have been 160-161 grains. Is it possible that the bullet sustained a weight loss of only 1.4 to 2.4 grains during the wounding of President Kennedy and Governor Connally?
- (60) —Could a 6.5-millimeter caliber Mannlicher-Carcano rifle be easily mistaken for a 7.65-millimeter caliber German Mauser rifle? What are the obvious differing characteristics, if any?
- (61) —Was the bullet found in 1974 by Richard Lester near the Texas School Bcok Depository fired from the Mannlicher-Carcano rifle?
- (62) —Could the iron sights found on the Mannlicher-Carcano rifle be used with a high degree of accuracy and operability, as compared with the telescopic sight?
- (63) —Do rifles using smokeless powder emit smoke discernible to the eye when fired?
- (64) The issues the committee asked the panel to address in the Tippitt shooting were as follows:
- (65) —What are the dimensional differences between a .38 S. & W. caliber cartridge and a .38 special caliber cartridge? Can a .38 special caliber cartridge be inserted in a weapon chambered for a .38 S. & W. caliber cartridge? Would this cause the side of the cartridge case to split, as happened with one of the cartridge cases test-fired by the FBI in Oswald's revolver?
- (66) —Were the four cartridge cases recovered from the scene of the Tippitt murder fired in the revolver recovered from Oswald when apprehended?
- (67) —Were the four bullets recovered from Officer Tippit's body fired from the revolver recovered from Oswald when apprehended?
- (68) —Of the four expended cartridge cases found at the scene of the Tippit murder, two were of Western Cartridge Co. manufacture, two of Remington-Peters. The autopsy of Tippit, however, revealed three bullets of Western Cartridge Co. manufacture and one of Remington-Peters. Can the panel formulate an opinion about this dis

crepancy? Is it possible to determine which bullet came from each particular cartridge case?

(69) The issues the committee asked the panel to address in the Oswald shooting were as follows:

(70) —Are there any characteristics which are easily identifiable of Jack Ruby's revolver? Does it have a "hair trigger"?

(71) —What can the panel determine from an examination of the Ruby evidence?

(72) During the course of its investigation but after the panel had completed its work in Washington, D.C., the committee obtained a bullet which had been found in 1967, by Rich Haythorne on top of the Massey Roofing Co. building in Dallas. The committee asked George R. Wilson, the panel's technical assistant who was with the police department in Washington, D.C., to determine if the Haythorne bullet had been fired from the Mannlicher-Carcano rifle.

(73) Wilson described the bullet as jacketed, soft-point and .30 caliber; its class characteristics were six lands and six grooves, right twist. The bullet weighed 149.3 grains. It was consistent with Remington-Peters ammunition.

(74) Wilson concluded that the physical characteristics of the bullet were different from those of Mannlicher-Carcano ammunition, as well as from the rifling characteristics of the Mannlicher-Carcano rifle. Therefore, the bullet definitely was not Mannlicher-Carcano ammunition and was not fired from the Mannlicher-Carcano rifle.

#### *Procedures and equipment*

(75) The panel conducted its examination at the firearm identification section of the Washington, D.C. Metropolitan Police Department. These facilities were conveniently located to the National Archives and the select committee's offices, and they were made available by Police Chief Maurice J. Cullinane and firearms section supervisor George R. Wilson.

(76) The firearms panel met on November 12, 1977, at the National Archives to conduct a cursory examination of the evidence stored there. On January 30, 1968, the panel and its technical assistant met with representatives of the select committee at the Washington, D.C., Metropolitan Police Department firearm identification section. The following procedures were adopted at that time:

(77) —The panel members would jointly conduct visual and microscopical examinations of the evidence in the possession of the select committee and the National Archives. Each examiner would submit an independent worksheet to the select committee on each item of evidence examined.

(78) —The panel would jointly determine the operability of the Mannlicher-Carcano rifle, the Oswald revolver and the Ruby revolver. Each firearm would be test fired to obtain bullets and cartridge cases for comparison purposes.

(79) —A joint firearms panel report would be submitted to the select committee at the completion of all examinations.

(80) The panel was to conduct visual and microscopical examinations, as necessary, on each item of evidence. A summary of general principles follows.



(81) A cartridge, or round of ammunition, consists of a cartridge case, primer, powder and bullet. The primer contains a detonable mixture and fits into the base of the cartridge case, which contains powder. The bullet, constructed of lead or a lead core encased in a stronger metal jacket, fits into the mouth of the cartridge case. A bullet is fired by placing the cartridge in the chamber of a firearm. The cartridge base rests against a solid support, called a breech or bolt face. When the trigger is pulled, the firing pin strikes the primer, igniting the detonable mixture, which in turn ignites the powder in the cartridge case. The combustion propels the bullet through the barrel.

(82) The bore (inside of the barrel) of modern firearms is "rifled" with spiral grooves in it to give bullets fired through it a spinning motion for flight stability. The raised portions between the grooves are called lands. The number, width and direction of twist of the lands and grooves are called the class characteristics of a barrel.

(83) In addition to the class characteristics, the components of every firearm, such as the barrel, firing pin and breech face, bear distinctive microscopic characteristics. While the class characteristics are common to all firearms of a given model and manufacture, an individual firearm's microscopic characteristics differ from all other firearms, regardless of model or manufacture. These distinctive markings, usually referred to as individual identifying characteristics, are produced initially by the manufacturing tools, which change microscopically during operation and vary from one firearm to another. Further individual identifying characteristics are produced as the firearm is used, during its disuse, and as a consequence of maintenance or the lack of it.

(84) When a firearm is discharged, the individual identifying characteristics of its barrel, as well as its class characteristics, are engraved on the bearing surface of the bullet. The individual identifying characteristics of the firing pin and breech or bolt face are impressed on the base or primer of the cartridge case at the time of firing. Using a comparison microscope, an expert can compare the markings with those produced on a similar cartridge test-fired in the same firearm. If the patterns of the microscopic markings are sufficiently similar, it can be concluded that both cartridge cases were fired in the same firearm. Microscopical examination of other firearm components and the markings they produce may also demonstrate such things as whether a cartridge was ever loaded into a particular firearm or was loaded into a firearm more than once. It is also possible, through comparative microscopical examinations, to determine whether two bullets were fired from the same firearm.

(85) In its examinations, the panel used the following equipment:

(86) —Two American Optical forensic comparison microscopes, model K1453, serial Nos. 328 and 277, with fluorescent and incandescent lighting, fiber optics, photographic unit and 10X eyepieces and objectives. One had a combined magnification of 12X, 20X, and 40X, the other 20X, 40X, and 80X.

(87) —American optical low power binocular microscope with a zoom lens of 0.7 to 3 power and 10X eyepiece.

(88) —Mico model 5100 balance with a 1,000-grain capacity.

(89) —Sliccomb "Speedmike" direct readout micrometer.

(90) —Brown and Sharpe stage micrometer for air gap measuring.

- (91) —Horizontal water recovery tank.
- (92) —Horizontal cotton waste recovery box.
- (93) —6.5-millimeter caliber Mannlicher-Carcano cartridges with full metal-jacketed bullets of Western Cartridge Co. manufacture. These were test fired by the panel in CE 139 and designated panel Kennedy T-1—T-4. (See Figs. 1 and 2.)
- (94) Additional 6.5-millimeter caliber Mannlicher-Carcano cartridges were used, unfired, for loading and unloading in the rifle to obtain class and individual identifying characteristics produced in that process.
- (95) Strict security measures were observed throughout the examinations. Public access to the firearms evidence at the National Archives was denied during this time. (70) A member of the Archives staff accompanied the evidence while it was examined at the Archives or removed and examined at the laboratory. The panel's materials—photographs, photomicrographs, test-fired bullets and cartridge cases—were secured in a safe in the firearm identification section at the District of Columbia Metropolitan Police Department.

## FINDINGS AND CONCLUSIONS OF THE FIREARMS PANEL CONCERNING THE KENNEDY ASSASSINATION

(96) The findings and conclusions were prepared by staff of the House Select Committee on Assassinations based on material submitted by the panel members. The panel has read and accepts those findings and conclusions.

### KENNEDY SHOOTING

#### *Evidence examined*

(97) The following evidence was examined in connection with the shooting of President Kennedy.

(98) CE 139(71).—One 6.5-millimeter caliber, bolt-action repeating rifle, Mannlicher-Carcano Model 1938, serial number C2766. Attached was an Ordnance Optics, Inc. 4X telescopic sight and an adjustable black leather strap.\* (See figs. 3A and 3B.)

(100) A visual examination of the rifle revealed pitting, rust and copper oxidation to test-firing, which the panel believed should be removed prior to test-firing. Accordingly, a dry cloth patch was pushed through the bore.

(101) The telescopic sight was attached to a mount, which itself was attached to the left side of the rifle. Mounting facilities were not provided at the time of manufacture. Also attached to the rifle were standard iron sights, placed on the rifle at the time of manufacture.

(102) The rifle was test-fired by all panel members, using 6.5-millimeter caliber ammunition of Western Cartridge Co. manufacture. Two bullets were test-fired into a horizontal water recovery tank. Further tests were conducted by loading four cartridges into the CE 375 cartridge clip and inserting it into the magazine of the rifle. The cartridges were worked through the rifle's mechanism and ejected without being fired. When the last cartridge was chambered, the cartridge clip remained in the magazine instead of falling out as it is designed to do.

(103) CE 141.—One 6.5-millimeter caliber cartridge of Western Cartridge Co. manufacture, found in the CE 139 rifle. (See fig. 4.)

(104) CE 351.—One damaged automobile windshield removed from the Presidential limousine. (See fig. 5.)

(105) CE 399.—One fired 6.5-millimeter caliber full metal-jacketed bullet, found on a stretcher in the emergency area of Parkland Hospital. The bullet weight was found to be 157.7 grains. (72) In the same box as the bullet was a tiny fragment, which was too small to weigh or otherwise examine. (See figs. 6A and 6B.)

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\*The CE 139 rifle was physically examined and found to be operable. It had not been properly cleaned, maintained or lubricated. The rifling of the barrel was four lands and four grooves, right twist. The magazine was a non-detachable box, clip-fed type, with a 6-cartridge capacity. The trigger pull was determined by the panel to be approximately 3 pounds.



(106) *CE 542*.—One 6.5-millimeter caliber, bolt-action repeating rifle, Mannlicher-Carcano model 1938, serial No. UC5209. Attached was 4 × Ordnance Optics, Inc., telescopic sight and an adjustable black leather strap. The strap is consistent in length, design, and construction with the strap on the CE 139 rifle. The rifle was purchased by the FBI in order to compare the method of mounting the telescopic sight. (See fig. 7.)

(107) *CE 543*.—One expended caliber 6.5-millimeter cartridge case of Western Cartridge Co. manufacture, recovered from the sixth floor of the Texas School Book Depository. (See figs. 8A and 8B.)

(108) *CE 544*.—One expended 6.5-millimeter caliber cartridge case of Western Cartridge Co. manufacture, recovered from the sixth floor of the Texas School Book Depository. (See fig. 9.)

(109) *CE 545*.—One expended 6.5-millimeter caliber cartridge case of Western Cartridge Co. manufacture, recovered from the sixth floor of the Texas School Book Depository. (See fig. 10.)

(110) *CE 557*.—Two expended 6.5-millimeter caliber cartridge cases of Western Cartridge Co. manufacture, test-fired by the FBI laboratory in the CE 139 rifle for purposes of comparison with CE 543, CE 544, and CE 545. (See Warren Commission hearings, vol. 17, p. 249.)

(111) *CE 567*.—The nose portion of a 6.5-millimeter caliber metal-jacketed bullet found on the right side of the front seat of the Presidential limousine. (See fig. 11.)

(112) *CE 569*.—The base portion of a metal-jacketed bullet found on the floor beside the right side of the front seat of the Presidential limousine. (See fig. 12.)

(113) *CE 572*.—Two fired 6.5-millimeter caliber full metal-jacketed bullets, test-fired by the FBI from the CE 139 rifle and designated as K1A and K1B\*. (See fig. 13.)

(114) *CE 573*.—One 6.5 millimeter caliber metal-jacketed bullet recovered from the residence of General Walker in April 1963 after an attempted assault. (See fig. 14.)

(115) *CE 575*.—One brass cartridge clip with a six-cartridge capacity, stamped "SMI 952," removed from the CE 139 rifle. (See fig. 15.)

(117) *CE 840*.—Two lead-like fragments\*\* recovered from the rug underneath or in the area which was underneath the left jump seat of the Presidential limousine. (73) The panel found that each fragment weighed 0.5 grain. Because of their minute size, no further examinations were conducted on this exhibit. (See fig. 16.)

(118) *CE 841*.—One round metal box containing lead residue recovered by the FBI from the inside surface of the windshield of the Presidential limousine. Because of the small size of the sample, further examinations were not conducted. (See hearings before the Warren Commission, vol. 17, p. 840.)

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\*The two test-fired bullets were used as standards for comparison with the class characteristics on CE 399, found on a stretcher at Parkland; with those on CE 567, the bullet nose portion found in the limousine; and with CE 569, the bullet base portion found in the limousine.

\*\*The FBI originally recovered three particles. In 1970, an independent researcher brought to the attention of the National Archives that one of the three fragments was missing. The Archives has been unable to locate it.

(119) *CE 842*.—Four lead-like fragments. The smallest was identified as having come from Governor Connally's arm. The panel found that the largest fragment weighed 0.3 grain. The other fragments were too small to weigh. Because of the small size of the fragments, no further examinations were conducted on this exhibit. (See fig. 17).

(121) *CE 843*.—Three lead-like fragments removed from President Kennedy's brain during the autopsy. The largest weighs 0.6 grain; their combined weight is 0.7 grain. Because of the small size of the fragments, no examinations were conducted on this exhibit. (See fig. 18.)

(122) *CE 853*.—One fired 6.5-millimeter caliber full metal-jacketed bullet, fired through a goat at the request of the Warren Commission to ascertain the characteristics of the bullet on penetration and its subsequent loss of velocity. The panel found that fruitful examination of this bullet was not practical. (See hearings before the Warren Commission, vol. 17, p. 819.)

(123) *CE 856*.—One fired 6.5-millimeter caliber full metal-jacketed bullet, test-fired through a cadaver's wrist at the request of the Warren Commission to ascertain the characteristics of the bullet on penetration and its loss of velocity on impact. The panel found that fruitful examination of this bullet was not practical. (See hearings before the Warren Commission, vol. 17, p. 850.)

(124) *CE 857*.—One fired 6.5-millimeter caliber full metal jacketed bullet, test-fired into a skull at the request of the Warren Commission to ascertain the characteristics of the bullet on penetration. The panel found that the jacket had been separated from the core. The panel also found that fruitful examination of the bullet was not practical. (See hearings before the Warren Commission, vol. 17, p. 851.)

(125) *Lester Bullet*.—One fired metal-jacketed soft or hollow point bullet found in 1974 by Richard Lester about 500 yards from the Texas School Book Depository and 61 paces east of the triple overpass abutment. (See fig. 19.)

### *Findings and Conclusions*

*Was the CE 141 cartridge reportedly found in the CE 139 rifle in fact loaded into that rifle?*

(126) The CE 141 cartridge was compared with the panel's unfired test cartridge No. 4, which had been loaded into the rifle and removed. The panel found a correspondence between the individual identifying characteristics produced by the magazine follower and the loading ramp of the CE 139 rifle on the CE 141 cartridge case and the panel's unfired cartridge. (See fig. 20.)

(127) In the Mannlicher-Carcano rifle, the loading ramp consists of a concave ramp located at the front edge of the magazine. It permits smooth insertion of the cartridge into the chamber. When a cartridge is chambered by moving the bolt forward, the front portion of the cartridge case slides up the loading ramp as it leaves the magazine. The loading ramp is a machined-steel surface and can engrave individual microscopic identifying characteristics on the cartridge case. Similarly, the magazine follower, which raises the cartridges, also may engrave individual microscopic identifying characteristics on the last cartridge in the magazine.



*From which direction was the impact which damaged the CE 351 windshield of the Presidential limousine?*

(128) The CE 351 windshield, made of two layers of laminated, tinted glass, has two separate fracture areas. (See fig. 5.) In the first (I), the point of impact is located  $13\frac{3}{8}$  inches down from the top edge and  $22\frac{7}{8}$  inches to the right of the left edge (the measurements were made from the front side of the windshield). No fractures were noted on the inside surface of the glass. On the outside surface, some fracture lines radiated out from the point of impact. The presence of fracture lines on the outside is indicative of a foreign object striking the windshield from the inside. (74)

(129) The second area (II) is located to the left of the first. No point of impact was found.

(130) Two lines, one radiating from each area, now connect at one point. This condition occurred after the panel's examination, but before the windshield was photographed. The additional fracture lines could have been caused by jolting the windshield during its removal from its exhibit case for photographing.

*Were the three expended cartridge cases (CE 543, CE 544 and CE 545) found on the sixth floor of the Texas School Book Depository fired in the CE 139 Mannlicher-Carcano rifle?*

(131) The panel compared microscopically the three expended cartridge cases (CE 543, CE 544, and CE 545) with the two cartridge cases test-fired by the FBI (CE 557) and the four cartridge cases (Kennedy T-1 to T-4) test-fired by the panel in the CE 139 rifle.

(132) The panel found correspondence among the individual identifying characteristics made by the firing pin and bolt face on the cartridge cases. (See Figs. 21A, B, C, and D.)

(133) The panel found, in addition to the above impressions, three sets of striations on the head of the CE 543 cartridge case. The marks were not found on any of the other 6.5-millimeter caliber cartridge cases. The origin of the marks could not be established.

(134) The panel concluded that all three cartridge cases had been fired in the CE 139 rifle.

*Was the CE 399 bullet found at Parkland Hospital fired from the CE 139 Mannlicher-Carcano rifle?*

(135) The CE 399 bullet is a 6.5-millimeter caliber full metal-jacketed, lead core bullet with a weight of 157.7 grains. The class characteristics engraved on it are four lands and four grooves, right twist.

(136) The panel found the physical characteristics of CE 399 to be the same as those of the bullet portion of the CE 141 cartridge found in the Mannlicher-Carcano rifle's chamber.

(137) CE 399 was microscopically compared with the two bullet test-fired by the FBI (CE 572) in the CE 139 rifle. Based in a correspondence of individual identifying characteristics, the panel concluded that CE 399 was fired through the same firearm barrel as the FBI test-fired bullets. (See fig. 22A and 22B.)

(138) Next, the panel compared CE 399 with bullets it test-fired in the CE 139 rifle. The panel was unable to identify its test-fired bullets



with the CE 399 bullet. The panel attributed this to changes in the bore caused by repeated firings of the rifle by the FBI and the Infantry Weapons Evaluation Branch of the U.S. Army to test its accuracy, (75) as well as to deterioration of the surfaces because the rifle had not been properly cleaned, lubricated, and maintained. For the same reasons, the panel was unable to identify its test-fired bullets with those of the FBI. The panel's test-fired bullets also could not be identified with each other, probably as a consequence of the poor condition of the barrel.

*Was the CE 567 bullet nose portion found on the right side of the front seat of the Presidential limousine fired from the CE 139 Mannlicher-Carcano rifle?*

(139) CE 567 is the nose portion of a damaged 6.5-millimeter caliber full metal-jacketed, lead core bullet. The weight of the exhibit is 41.5 grains. The class characteristics on the jacket are four lands and four grooves. The panel could not determine the direction of twist.

(140) The panel found the physical characteristics of this bullet fragment to be the same as the bullet portion of the CE 141 cartridge found in the chamber of the CE 139 rifle. When it compared CE 567 with the two CE 572 bullets test-fired by the FBI in the CE 139 rifle, it noted a correspondence among the individual identifying characteristics. (See fig. 23A and 23B.)

(141) The panel concluded that all were fired through the same barrel.

(142) The panel also compared CE 567 with bullets it test-fired in the CE 139 rifle. The panel was unable to identify its tests with CE 567. The panel attributed this to changes in the bore caused by repeated firing of the rifle by the FBI and the Infantry Weapons Evaluation Branch of the U.S. Army to test its accuracy, (76) as well as deterioration of the surfaces because the rifle had not been properly cleaned, lubricated, and maintained. For the same reasons, the panel was unable to identify its test-fired bullets with those of the FBI. The panel's test-fired bullets also could not be identified with each other, probably as a consequence of the poor condition of the barrel.

*Was the CE 569 bullet-base portion found on the floor beside the right front seat of the Presidential limousine fired from the CE 139 rifle?*

(143) CE 569 is a base portion of a damaged 6.5-millimeter caliber full metal-jacketed, lead core bullet. The weight of 20.6 grains. The rifling impressions on the jacket are four lands and four grooves, right twist. The physical characteristics of this bullet are the same as the bullet portion of the CE 141 cartridge found in the chamber of the CE 139 rifle.

(144) The panel microscopically compared this bullet jacket with the two bullets (CE 572) test fired by the FBI from the CE 139 rifle. Correspondence of individual identifying characteristics was found on CE 569 and the FBI test-fired bullets. (See figs. 24A and 24B.)

(145) The panel concluded that the CE 569 was fired through the same barrel as the FBI test-fired bullets.

(146) Next, the panel compared CE 569 with bullets it test fired in the CE 139 rifle. The panel was unable to identify its tests with the

CE 569. The panel attributed this to changes in the bore caused by repeated firings of the rifle by the FBI and the Infantry Weapons Evaluation Branch of the U.S. Army to test its accuracy, (77) as well as to deterioration of the surfaces because the rifle had not been properly cleaned, lubricated, and maintained. For the same reasons, the panel was unable to identify its test-fired bullets with those of the FBI. The panel's test-fired bullets also could not be identified with each other, probably as a consequence of the poor condition of the barrel.

*Were the CE 567 bullet nose portion and the CE 569 bullet base portion found in the Presidential limousine components of the same bullet?*

(147) The panel was unable to determine whether CE 567 and CE 569 were components of the same bullet. The panel weighed and measured the fragments and found their combined weight and length did not exceed that of a single-fired projectile. Nevertheless, the panel could not match the two fragments physically because a considerable portion of the bullet jacket was absent.

(148) Both bullet fragments were examined for cannellures. The panel found only one cannellure present; it was on the base portion of the CE 569 bullet.

*Was the CE 573 bullet recovered from the residence of General Walker fired from the CE 139 rifle?*

(149) CE 573 consists of a damaged 6.5-millimeter caliber full metal-jacketed, lead core bullet. The weight of this exhibit is 147.1 grains. The class characteristics are four lands and four grooves, right twist. (See fig. 14.)

(150) The panel compared this bullet microscopically with the FBI's and its own test-fired bullets. Correspondence among the class characteristics was found on all bullets. No significant correspondence was, however, found among the individual identifying characteristics. Conversely, gross differences were not found.

(151) The panel concluded that because of the damage to CE 573 caused by impact and penetration, it could not be identified or eliminated as having been fired from the CE 139 rifle.

*What are the nature and characteristics of the 6.5-millimeter caliber Mannlicher-Carcano rifle and ammunition with respect to power and impact?*

(152) The 6.5-millimeter caliber Mannlicher-Carcano rifle is a bolt-action military rifle used as the standard service rifle by the Italian military from 1891 to 1945. It was chambered for a 6.5-millimeter caliber Mannlicher-Carcano cartridge. It was comparable to the service rifles of other nations at that time. These rifles include the U.S. model 1903 Springfield and 1917 Enfield, chambered for the .30-06 Springfield caliber cartridge; the British .303 Enfield, chambered for the .303 British caliber cartridge; the German 8-millimeter Mauser, chambered for the 8-millimeter Mauser caliber cartridge; and the Japanese Arisaka, chambered for both the 7.7-millimeter Arisaka caliber cartridge and 6.5-millimeter caliber Japanese Arisaka cartridge. The standard military factory statistics for these cartridges are: (78)



Cartridge	Bullet weight (grains)	Muzzle velocity (feet per second)	Muzzle energy (foot per pound)
.30-06 Springfield-----	150	2, 990	2, 980
.303 British-----	174	2, 440	2, 310
8-millimeter Mauser-----	154	2, 880	2, 835
7.7-millimeter Japanese Arisaka-----	175	2, 400	2, 237
6.5-millimeter Mannlicher-Carcano-----	162	2, 296	1, 902
6.5-millimeter Japanese Arisaka-----	156	2, 060	1, 460

*Could the CE 139 rifle have been fired with a high degree of accuracy even though it has been described as having a "hair trigger"?*

(153) The trigger pull of CE 139 is approximately 3 pounds, not considered average for most military rifles. At the same time, it cannot be called "a hair trigger." Technically, a hair trigger requires an extremely light pull, normally measured at 16 ounces or less. Furthermore, the panel's examination of CE 139 disclosed that, as in most military weapons, it has a two-stage trigger that requires some movement of the trigger before the sear mechanism is engaged, allowing the weapon to fire.

(154) It is the opinion of the panel that the CE 139 does not have a hair trigger that would affect accurate aiming and firing.

*Would the dent on the mouth of CE 543, one of the three expended cartridge cases found on the sixth floor of the Texas School Book Depository, prevent the bullet from being fired in the CE 139 Mannlicher-Carcano rifle, or any other rifle? Can it be determined whether these cartridge cases had been chambered on more than one occasion?*

(155) Figure 8B shows a dent on the mouth of the CE 543 cartridge case which Josiah Johnson, a critic of the Warren Commission, said would prevent CE 543 from being fired in any rifle. (79)

(156) It is the opinion of the panel that the dent on the mouth of the CE 543 cartridge case was produced when the cartridge case was ejected from the rifle. This condition was duplicated during test-firing of the CE 139 rifle by the panel. (See fig. 2.) The dent had nothing to do with loading the bullet during the manufacturing process, nor is it the type of deformation expected if the case were stepped on.

(157) There was no evidence in the form of multiple extractor or ejector marks on the cartridge case to indicate that it was chambered in the rifle more than once. This also applies to cartridge cases CE 544 and CE 545.

*Does the method of mounting a scope on a rifle affect, or have any influence on whether the rifle can be fired by a left-handed individual?*

(158) There is no such thing as a left- or right-handed telescopic sight. The location of a telescopic sight on a rifle is determined not by whether it is to be shot left-handed or right-handed, but rather by such factors as receiver design, cartridge case ejection direction and bolt handle travel pattern. On CE 139, the telescopic sight is mounted on the left side of the receiver because of the vertical bolt handle travel pattern and the split receiver (see fig. 1). Because this rifle has a right-



handed action, a telescopic sight cannot be mounted on the right side of the receiver.

(159) The position of the bolt in a bolt-action rifle, that is, right- or left-handed action, is the factor that influences ease of operation, rather than the placement of the telescopic sight. A left-handed action would be difficult for a right-handed individual to operate, and conversely, a right-handed action would be difficult for a left-handed individual to operate.

*The Warren Commission found that the CE 399 stretcher bullet weighed 158.6 grains (80) when recovered and assumed its original weight before firing to have been 160–161 grains. Is it possible that the CE 399 bullet sustained a weight loss of only 1.4 to 2.4 grains during the wounding of President Kennedy and Governor Connally?*

(160) Because of manufacturing variations, all bullet weights are approximate, and it is not possible to determine the exact weight loss of a fired bullet without knowing its exact weight prior to firing. Nevertheless, it is possible that the weight loss from friction, pressure and intense heat during the firing process, and the weight loss caused by impact and penetration, would not have exceeded the range of 1.4 to 2.4 grains. The panel was, however, unable to render a definite opinion.

*Could a 6.5-millimeter caliber Mannlicher-Carcano rifle be easily mistaken for a 7.65-millimeter caliber German Mauser rifle? What are the obvious differing characteristics, if any?*

(161) In the opinion of the panel, a Mannlicher-Carcano rifle could very easily be mistaken for other military rifles of its general type, including the 7.65-millimeter caliber German and other model Mausers.

(162) At one time, bolt-action rifles like the German Mauser, the Argentine Mauser (which is made in Germany) and the Mannlicher-Carcanos were the standard military weapons of most countries. Although manufactured in many different calibers and models, all have the same general characteristics—right-hand action (bolt mechanisms), a full-length wooden stock covering most of the barrel, a sling attachment, bayonet mounting lugs and a generally rough and dull appearance. In the absence of a complete examination, almost any such bolt-action military rifle could be confused with a Mannlicher-Carcano rifle. (See figs. 1, 2, and 25.)

(163) Further, the caliber of a rifle cannot be determined merely by looking at it. For example, the bore of the 7.65-millimeter caliber German Mauser, or other 7.65-millimeter caliber rifles, is only 0.05 inches larger than the 6.5-millimeter caliber Mannlicher-Carcano. Even if a knowledgeable individual identified a particular rifle after a cursory examination, it is unlikely that the caliber could be readily established without further examination.

*Was the bullet found in 1974 by Richard Lester near the Texas School Book Depository fired from the CE 139 Mannlicher-Carcano rifle?*

(164) The panel found the Lester bullet to be the base portion of a metal-jacketed, softpoint or hollowpoint bullet. It weights 52.7 grains and is consistent in diameter with 6.5-millimeter caliber bullets. The rifling impressions are four lands and four grooves, right twist.

(165) The panel found that the physical characteristics of this bullet were different from the CE 399 bullet recovered at Parkland Hospital and the CE 567 and CE 569 bullet fragments recovered from the Presidential limousine. When the panel compared the bullet microscopically with the CE 572 FBI test-fired bullets, it noted gross differences among class characteristics. As a result, the panel concluded that this bullet was not fired through the same firearm barrel as the FBI test-fired bullets.

*Could the iron sights found on the CE 139 Mannlicher-Carcano rifle be used with a high degree of accuracy and operability, as compared with the telescopic sight?*

(166) The iron sights found on CE 139 are the standard, fixed sights placed on the firearm at the time of manufacture at the military arsenal. On CE 139, a block of metal is attached to the area immediately in front of the chamber area. A V-shaped notch in this piece of metal acts as the rear sighting alinement device. The sighting is made by lining up the front sight in the notch of the rear sight. A fixed sight cannot be adjusted for windage or elevation.

(167) The 4X scope mounted on this particular weapon is designed so that the cross hairs move from the center position when adjusting for windage or elevation. Hence the shooter is not always looking dead center through the scope.

(168) It is the opinion of this panel that an individual could attain better accuracy using the iron sights than the scope under the circumstances involved in Dealey Plaza.

*Do rifles using smokeless powder emit smoke discernible to the eye when fired?*

(169) When a cartridge is fired, the propellant is not completely consumed or burned. Due to this, residue and smoke are emitted. During the test firing of CE 139 by the members of the panel, in October, some smoke was observed coming from the muzzle of the weapon.

#### TIPPIT MURDER

##### *Evidence examined*

(170) CE 143—One .38 special caliber Smith and Wesson revolver, Victory model, serial No. V510210, seized from Oswald when he was apprehended in the Texas theater. (See figs. 26A and 26B.)\* The barrel is rifled with five lands and five grooves, right twist. The cylinder has a six-cartridge capacity.

(172) The CE 143 revolver had been altered to accept .38 special caliber ammunition and presumably to allow easier concealment, as follows:

1. The barrel had been shortened from the muzzle end to its present length of  $2\frac{1}{4}$  inches.
2. The muzzle end had been recrowned.
3. The cylinder had been rechambered from .38 S. & W. caliber to accommodate .38 special caliber cartridges.
4. The front sight had been reset.

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\*The panel found the revolver to be in good operating condition. It can be fired single action or double action. The trigger pull was measured at about  $3\frac{1}{2}$  pounds single action and  $10\frac{1}{4}$  pounds double action.



5. The "U.S. Property" markings located on the left side of the top strap had been partially obliterated.
  6. The lanyard swivel and ring had been removed and the hole filled with metal.
- (173) CE 143 was test-fired four times by the panel into a horizontal water recovery tank, using two Western Cartridge Co. .38 special caliber cartridges with 158-grain, copper-coated (Lubaloy), lead, round-nose bullets, and two Remington-Peters .38 special caliber cartridges with 158-grain, plain lead, round-nose bullets.
- (174) CE 518—Four cartridges found in the CE 143 revolver. Two cartridges, designated Q78 and Q79 by the FBI, are Western Cartridge Co. .38 special caliber cartridges with copper-coated (Lubaloy), lead, round-nose bullets. The other two, designated Q80 and Q81 by the FBI, are Remington-Peters .38 special caliber cartridges with plain lead, round-nose bullets.\* (See fig. 27.)
- (175) CE 587—One Western Cartridge Co. .38 S. & W. caliber cartridge with a copper-coated (Lubaloy), lead, roundnose bullet, acquired by the FBI and used as a standard. (See hearings before the Warren Commission, vol. 17, p. 264.)
- (176) CE 588—One Western Cartridge Co. unfired .38 S. & W. caliber cartridge case and one unfired .38 caliber copper-coated (Lubaloy), lead, round-nose bullet, weighing 145.1 grains and measuring 0.635 inch long, acquired by the FBI. Both were used as standards. (See hearings before the Warren Commission, vol. 17, p. 264.)
- (178) CE 589—Assembled and disassembled cartridges—one Remington-Peters .38 S. & W. caliber cartridge with a plain lead, round-nose bullet measuring 1.20 inches long overall; one Remington-Peters unfired .38 S. & W. caliber cartridge case measuring 0.763 inch long and one unfired .38 S. & W. caliber plain lead, round-nose bullet measuring 0.661 inch long. The FBI used these as standards. (See hearings before the Warren Commission, vol. 17, p. 264.)
- (179) CE 590—Assembled and disassembled cartridges—one Western Cartridge Co. .38 special caliber cartridge with a copper-coated (Lubaloy), lead, round-nose bullet measuring 1.530 inches long; one unfired Western Cartridge Co. .38 special caliber cartridge case measuring 1.150 inches long; and one .38 special caliber copper-coated (Lubaloy), lead, round-nose bullet measuring 0.730 inch long. The cartridges and components in this exhibit were used by the FBI as standards. (See hearings before the Warren Commission, vol. 17, p. 264.)
- (180) CE 591—Assembled and disassembled cartridges—one Remington-Peters .38 special caliber cartridge with a plain lead, round-nose bullet measuring 1.550 inches long overall; one unfired Remington-Peters .38 special caliber cartridge case measuring 1.150 inches long; and one .38 caliber plain lead, round-nose bullet measuring 0.730 inch long. The FBI used these as standards. (See hearings before the Warren Commission, vol. 17, p. 264.)
- (181) CE 592—Five Western Cartridge Co. .38 special caliber cartridges with copper-coated (Lubaloy), lead, round-nose bullets, found

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\*The panel's visual and microscopic examinations revealed no markings that could be attributed to any attempt to discharge them in a firearm.



in Oswald's trouser pocket, designated Q82 through Q86 by the FBI.\* (See fig. 28.)

(183) *CE 594*.—Four expended cartridge cases retrieved from the scene of the Tippit murder, designated Q74 through Q77 by the FBI. Q75 and Q76 are .38 special caliber of Western Cartridge Co. manufacture; Q74 and Q77 are .38 special caliber of Remington-Peters manufacture. (See fig. 29.)

(184) *CE 595*.—Two cartridge cases test-fired by the FBI in the CE 143 revolver—one Winchester Repeating Arms .38 special caliber designated K3 by the FBI\*\* and one Western Cartridge Co. .38 special caliber, designated K3 by the FBI. (See fig. 30.)

(185) *CE 602*.—One .38 special caliber copper-coated (Lubaloy), lead, round-nose bullet, and one damaged, brass-colored button with the lettering "city of Dallas." The bullet and button were removed from the body of Officer Tippit. The bullet is consistent with Western Cartridge Co. manufacture. The class characteristics are five lands and five grooves, right twist. The weight is 155.4 grains. (See fig. 31.)

(186) *CE 603*.—One .38 special caliber copper-coated (Lubaloy), lead, round-nose bullet removed from the body of Officer Tippit. The bullet is consistent with Western Cartridge Co. manufacture. The class characteristics are five lands and five grooves, right twist. The weight is 155.1 grains. (See fig. 32.)

(187) *CE 604*.—One .38 special caliber lead, round-nose bullet removed from the body of Officer Tippit. The bullet is consistent with Remington-Peters manufacture. The class characteristics are five lands and five grooves, right twist. The weight is 154.7 grains. (See fig. 33.)

(188) *CE 605*.—One .38 special caliber copper-coated (Lubaloy), lead, round-nose bullet removed from the body of Officer Tippit. The bullet is consistent with Western Cartridge Co. manufacture. The class characteristics are five lands and five grooves, right twist. The weight is 152.8 grains. (See fig. 34.)

(189) *CE 606*.—Two bullets test-fired by the FBI in the CE 143 revolver, as follows: One .38 special caliber lead, round-nose bullet consistent with Winchester Repeating Arms manufacture; and one .38 special caliber copper-coated (Lubaloy), lead, round-nose bullet consistent with Western Cartridge Co. manufacture. (See hearings before the Warren Commission, vol. 17, p. 271.)

(191) *Panel Tippit T-1—T-4*.—T-1 and T-2: .38 special caliber cartridges of Remington Cartridge Co. manufacture, with lead bullets (see figs. 35A, 35B, and 35E); T-3 and T-4: .38 special caliber cartridges of Western Cartridge Co. manufacture with copper-coated (Lubaloy), lead, round-nose bullets (see figs. 35C, 35D, and 35E).

(192) All cartridges were test fired by the panel into a horizontal water-recovery tank.

### *Findings and Conclusions*

*What are the dimensional differences of a .38 S. & W. caliber cartridge and a .38 special caliber cartridge? Can a .38 special caliber*

\*The panel's visual and microscopic examination revealed no markings which could be attributed to any attempt to discharge them in a firearm.

\*\*The panel found a split in the side of the Winchester Repeating Arms cartridge case. (See fig. 30.)

*cartridge be inserted in a weapon chambered for a .38 S. & W. caliber cartridge? Would this cause the side of the cartridge case to split, as happened with the CE 595 cartridge case test fired by the FBI in Oswald's revolver?*

(193) A .38 S. & W. caliber cartridge and the .38 special caliber cartridge differ in the diameter of the neck, head and rim, and in length. The standard dimensions are: (81)

[In inches]

	.38 S & W	Average	.38 special	Average
Diameter neck-----	0. 375-0. 386	0. 380	0. 372-0. 378	0. 375
Diameter head-----	. 379-. 386	. 381	. 372-. 379	. 376
Diameter rim-----	. 424-. 441	. 433	. 424-. 444	. 434
Length-----	. 725-. 794	. 760	1. 120-1. 168	1. 144

(194) The .38 S&W caliber cartridge is approximately 0.005 inch larger in neck and head diameters, 0.001 inch smaller in rim diameter, and 0.384 inch shorter in case length. (82)

(195) Overall length of the .38 S&W caliber cartridge is approximately 1.20 inches. Overall length of the .38 special caliber cartridge is approximately 1.55 inches. (83)

(196) A revolver designed and manufactured to accept a .38 S&W caliber cartridge cannot fire a .38 special caliber cartridge without modification. One common method of modification is rechambering the cylinder.

(197) The panel noted that one of the FBI test-fired cartridge cases was split on the side. The panel attributed this split to one or more of the following factors: (1) The oversized chamber on the CE 143 revolver; (2) a weak cartridge case sidewall; or (3) excessive chamber pressures. During the panel's test firing of the CE 143 revolver, one test cartridge case split in a similar manner, which it attributed to the same possible causes.

*Were the four cartridge cases (CE 594) recovered from the scene of the Tippit murder fired in the CE 143 revolver recovered from Oswald when apprehended?*

(198) The panel microscopically compared the four CE 594 cartridge cases with the two CE 606 cartridge cases test-fired by the FBI and the four cartridge cases test fired by the panel in the CE 143 revolver. The panel found correspondence among the individual identifying characteristics produced by the firing pin and breech face. The panel concluded the four CE 494 cartridge cases were fired in the CE 143 revolver. (See figs. 36 A, B, C, and D and 36E.)

*Were the four bullets recovered from officer Tippit's body (CE 602 through CE 605) fired from the CE 143 revolver recovered from Oswald when apprehended?*

(199) The panel conducted microscopical examinations and comparisons of the four bullets recovered from Tippit's body (CE 602 through CE 605), the two bullets test fired by the FBI (CE 606), and the four



bullets (Tippit T-1 through T-4) test fired by the panel in the CE 143 revolver.

(200) The panel found correspondence among the class characteristics on all the fired bullets. Nevertheless, no significant correspondence was found among the individual identifying characteristics of CE 602 through CE 605 and the test-fired bullets. Conversely, no gross differences were found. The finding was inconclusive because of the extensive damage to the bullets recovered from Tippit's body. The panel attributed this to the effects of impact, penetration and wiping. Portions of the bearing surfaces of the CE 602 through CE 605 bullets also showed indications of gas erosion, which is caused by the hot gases produced by the burning of the propellant powder. The panel attributed this to the firing of either undersized bullets through the CE 143 barrel or the barrel of the revolver having become oversized due to wear and deterioration.

(201) The panel's two test-fired lead bullets could be identified with each other, as could its two test-fired copper-coated (Lubaloy) lead bullets. The lead and the copper-coated bullets could not, however, be identified with one another. The panel attributed these differences to variations in the composition of bullet surface materials.

(202) Due to the inconsistent markings on the recovered bullets and on all the test-fired bullets, the panel concluded that the CE 602 through CE 605 bullets could not be conclusively identified or eliminated as having been fired from the CE 143 revolver. (See figs. 31, 32, 33, 34, 35A, 35B, 35C, and 35D.)

*Of the four expended cartridge cases found at the scene of the Tippit murder, two were of Western Cartridge Co. manufacture, two of Remington-Peters. The autopsy of Tippit, however, revealed three bullets of Western Cartridge Co. manufacture and one of Remington-Peters. Can the panel formulate an opinion about this discrepancy? Is it possible to determine which bullet came from each particular cartridge case?*

(203) The two expended .38 special caliber cartridge cases (CE 574—Q75 and Q76) of Western Cartridge Co. manufacture and three of the recovered .38 special caliber copper-coated (Lubaloy) lead bullets (CE 602, CE 603, and CE 605) are components of Western Cartridge Co. ammunition. The two expended Remington-Peters cartridge cases (CE 594—Q74 and Q77) and the recovered .38 special caliber lead bullet (CE 604) are components of Remington-Peters Co. ammunition.

(204) The panel concluded that they were all components of factory-loaded ammunition. Visual and microscopical examination of the recovered cartridge cases revealed no evidence of reloading. It is logically assumed that cases and bullets of the same manufacture could have originated from the recovered cartridge cases and bullets, but the panel can render no opinion beyond this. There is no known scientific procedure that can conclusively relate a fired bullet to an expended cartridge case.

(205) The panel offers two possible explanations for the discrepancy:

1. One Western cartridge case was not recovered or is missing, and one Remington-Peters lead bullet missed Officer Tippit and also was not recovered.
2. One Western cartridge case was not recovered or is missing, and one fired Remington-Peters cartridge case was in the revolver prior to the Tippit shooting.



(206) Inasmuch as the panel's examinations were related to physical evidence only, a hypothesis to account for the discrepancy regarding the recovered cartridge cases and bullets is speculation. (See figs. 24, 31, 32, 33, and 34.)

#### OSWALD MURDER

##### *Evidence examined*

(207) *Jack Ruby Revolver*.—A .38 special caliber Colt Cobra revolver, serial No. 2744-LW, recovered from Jack Ruby at the time of his arrest in the Dallas Police Department basement on November 24, 1963. (See figs. 37A and 37B.)\*

(209) *Panel Ruby T-1 through T-6:*

—*Ruby T-1 and T-2*—Two .38 special caliber cartridges of Remington-Peters manufacture, with 158-grain, plain lead, round-nose bullets, test-fired in the Ruby revolver into a horizontal water recovery tank. (See fig. 38A.)

—*Ruby T-3 and T-4*—Two .38 special caliber cartridges of Western Cartridge Co. manufacture, with 158-grain, copper-coated (Luballoy), lead, round-nose bullets, test-fired in the Ruby revolver into a horizontal water recovery tank. (See fig. 38B.)

—*Ruby T-5 and T-6*—Two .38 special caliber cartridges of Remington Arms Co. manufacture, with 130-grain, full metal-jacketed, round-nose bullets, test-fired in the Ruby revolver into a horizontal water recovery tank. (See fig. 38C.)

##### *Findings and conclusions*

*Are there any characteristics which are easily identifiable on Jack Ruby's revolver? Does it have a "hair trigger"?*

(210) There was nothing out of the ordinary about Jack Ruby's revolver except that it had a hammer shroud, which is an attachment that covers most of the hammer of a weapon. The purpose of a shroud is to prevent the hammer from snagging on clothing. It was impossible to determine if the shroud was installed at the factory.

(211) The trigger pull was found to be slightly above the maximum weight specified by the factory; the revolver, therefore, cannot be said to have a "hair trigger."

*What can the panel determine from an examination of the Ruby evidence?*

(212) The panel members conducted a microscopical examination and comparison of the cartridge case and bullet components of two of its test-fired cartridges (Panel Ruby T-5 and T-6). Based on the correspondence among the individual identifying characteristics produced by the breech face and firing pin, the panel concluded that the cartridge cases could be identified with each other. Regarding the bullet components, they could also be identified with each other, based on the correspondence of individual identifying characteristics.

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\*The panel physically examined the revolver and found it to be in good operating condition. It can be fired single action or double action. The trigger pull was measured at approximately 5 pounds single action and 10½ pounds double action, slightly above the maximum weight specified by the factory. The barrel is rifled with six lands and six grooves, left twist. The cylinder has a six-cartridge capacity.

(213) Photomicrograph and microscopical comparisons of the panel's test-fired cartridge cases and bullets with those connected with Oswald's murder were not conducted. As noted earlier, the bullets that killed Oswald and the expended cartridge case recovered from the Ruby revolver were not located by the committee. This evidence was presented at Jack Ruby's trial, but its ultimate disposition was unknown. The panel recommended that an appropriate examination be conducted on this evidence if and when it is located.

#### SUMMARY AND CONCLUSIONS

(214) The CE 139 Mannlicher-Carcano military rifle was found by the panel to be operable. It was in generally poor condition because of a lack of proper cleaning, maintenance or lubrication. Although the trigger pull was found to be light, the panel concluded it was not a "hair trigger." The mounting of the telescopic sight on the left side of the rifle was done as a matter of necessity because the bolt action is on the right side.

(215) As to the misidentification of the rifle as a German Mauser, many bolt-action military rifles are so similar in profile that misidentification may occur.

(216) After examining the CE 141 cartridge found in the chamber of the CE 139 rifle, the panel concluded that it had in fact been worked through the action of that rifle from the magazine.

(217) The three expended cartridge cases found on the sixth floor of the depository building were compared microscopically by the panel with the FBI test-fired cartridge cases and those test-fired by the panel in the CE 139 rifle. Based on a correspondence of individual identifying characteristics produced by the firing pin and bolt face, the panel concluded that all three were fired in the CE 139 rifle.

(218) In the opinion of the panel, the dent on the mouth of the CE 543 case (one of three found on the sixth floor) was made by the CE 139 rifle during ejection. The panel duplicated the dent when it test-fired the rifle.

(219) The panel found no evidence of multiple extractor or ejector marks on the cartridge cases which would indicate that they had been chambered on more than one occasion.

(220) The panel compared microscopically the CE 399 stretcher bullet with the two bullets test-fired by the FBI (CE 572) in the CE 139 rifle. Based on a correspondence of individual identifying characteristics, the panel concluded that CE 399 was fired from the same barrel as the FBI test-fired bullets.

(221) The panel then compared microscopically the bullets it test-fired in the CE 139 rifle with the FBI test-fired bullets and with the CE 399 stretcher bullet. The panel was unable to identify its test-fired bullets with those of the FBI or with the CE 399 bullet, nor could the panel's test-fired bullets be identified with each other. The panel attributed the results to one or more of the following factors:

1. Repeated test-firing of the CE 139 rifle, which had caused extensive changes in the rifling characteristics within the barrel, or
2. Deterioration of rifling surfaces within the barrel of the CE 139 rifle over an extended period of time because of a lack of proper cleaning, maintenance, and protective lubrication.



(222) The panel compared the CE 567 bullet fragment (nose portion) and the CE 569 bullet fragment (base portion), both found in the limousine, with the two FBI test-fired bullets (CE 572). Based on a correspondence of their individual identifying characteristics, the panel concluded that CE 567, CE 569, and the two FBI test-fired bullets were all fired through the same barrel. Again, the panel was unable to identify these bullets and fragments with its own test-fired bullets. The panel was unable to determine if CE 567 and CE 569 originated from the same bullet.

(223) The CE 573 Walker bullet was compared microscopically with the FBI test-fired bullets. A correspondence of class characteristics was found, but a correspondence of individual identifying characteristics was not found. Conversely, no gross differences were noted. The panel concluded that the Walker bullet was too damaged to allow conclusive identification of the bullet with a particular firearm.

(224) Because of their minute size, microscopic examinations were not performed on the following: CE 840—lead-like fragments found in the limousine; CE 841—lead residue removed from the limousine's windshield; CE 842—four lead-like fragments removed from Governor Connally's wrist; and CE 843—three lead-like fragments removed from President Kennedy's brain during his autopsy at Bethesda Naval Hospital.

(225) The panel concluded from its examination of the bullet fragment found near the depository building by Richard Lester in 1974 that it was not fired through the same barrel as the FBI test-fired bullets and that its physical characteristics were different from the CE 399 stretcher bullet and the CE 567 and CE 569 bullet fragments found in the Presidential limousine.

(226) The panel found the CE 143 Oswald revolver to be in good operating condition. The trigger pull was not considered exceptionally light and could not be considered a "hair trigger." The revolver had been altered; changes included the shortening of the barrel and the modification of the chamber to accommodate .38 special caliber cartridges.

(227) The panel compared microscopically the four expended cartridge cases found at the scene of the Tippit murder (CE 594) with the cartridge cases test-fired by the FBI and by the panel in the CE 143 revolver. Based on the correspondence of individual identifying characteristics produced by the breech face and firing pin, the panel concluded that all four cartridge cases were fired in the CE 143 revolver. The panel also examined the five cartridges found in Oswald's pocket after his arrests (CE 592). No marks were found that could be attributed to an attempt to discharge them in a firearm.

(228) The panel noted that one of the FBI test-fired cartridge cases was split on the side. The panel attributed this split to either an oversized chamber, a weak cartridge case sidewall, excessive chamber pressure, or some combination of these factors. One of the panel's test-fired cartridge cases split in a similar manner during the test-firing of the CE 143 revolver.

(229) The panel examined the four bullets removed from the body of Officer Tippit during his autopsy. All four had sustained considerable damage from impact, penetration, and wiping. CE 604 was found



to be consistent with Remington-Peters manufacture, while CE 602, 603, and 605 were found to be consistent with Western Cartridge Co. manufacture. A correspondence was found among the number of lands and grooves and direction of twist of all four bullets, but no significant correspondence among individual identifying characteristics was found when the Tippit bullets were compared with bullets test-fired by the FBI or the panel in the CE 143 revolver. Consequently, the panel was unable to conclude that the Tippit bullets were fired from the CE 143 revolver. Conversely, the panel was unable to eliminate the bullets as having been fired from the CE 143 revolver.

(230) The Tippit bullets, the FBI, and the panel test-fired bullets all showed variations in their individual identifying characteristics, which commonly result from firing under-sized bullets in a barrel or the firing of normal-sized bullets in a firearm that has become over-sized due to wear and deterioration.

(231) The panel took note of a discrepancy between the brand of the bullets removed from Tippit's body and the brand of the cartridge cases found at the Tippit murder scene. Three of the recovered bullets were of Western Cartridge Co. manufacture, the fourth of Remington-Peters manufacture. Of the four recovered cartridge cases, however, two were of Western Cartridge Co. manufacture and two were of Remington-Peters manufacture. The panel gave two possible explanations. First, one Western cartridge case was not recovered and one Remington-Peters bullet missed Officer Tippit and also was not recovered. Second, one Western cartridge case was not recovered, and one Remington-Peters cartridge case was in the revolver prior to the Tippit shooting. The panel noted that its function was to examine the physical evidence as presented by the select committee. Hypotheses about the discrepancies in the physical evidence were beyond its scope of responsibility.

(232) The Jack Ruby revolver, which was seized from him at the time of his apprehension in the basement of the Dallas Police Department, was examined by the panel and found to be in good operating condition. The trigger pull was measured and found to be in the normal range; the revolver did not have a "hair trigger."

(233) The barrel of the Ruby revolver is rifled with six lands and six grooves, left twist. The only thing out of the ordinary is that the revolver has a hammer shroud, which protects against snagging on clothing. There was no way to determine if the shroud was put on the revolver at the factory.

(234) The panel could not conduct a microscopical examination of the fatal bullet or the cartridge case from which it originated because the evidence has not been located. The panel suggested that such an examination be conducted when and if the evidence is found.

#### *Recommendations of the firearms panel*

(235) The panel found that the firearms evidence had not been maintained in proper condition. It strongly recommended that the firearms evidence—cartridges, cartridge cases, bullets and fragments—be permanently sealed. More specifically:

1. All foreign material should be removed from the exhibit with a mild solution of saline or hemosol.

2. After cleaning, they should be handled with cotton gloves to prevent oxidation from body fluids.
  3. They should then be sealed in airtight plastic containers.
- (236) With respect to the rifle and revolver, the panel recommended that:
1. The foam rubber packing material in their storage cases should be removed and replaced with nonmoisture absorbing partitions.
  2. The storage cases should have small ventilation holes drilled in them to prevent condensation.
  3. The rifle and revolver should be cleaned and lightly oiled or protected with a silicone compound. All future handling should be done with clean cotton gloves.
- (237) The cleaning and sealing of the evidence could appropriately be done by the firearms panel.

## ILLUSTRATIONS

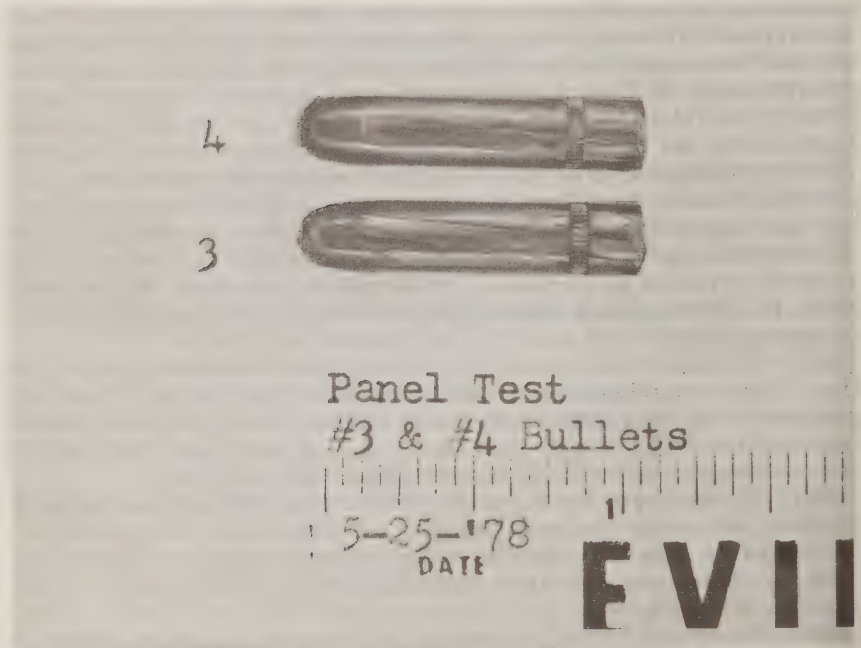


FIGURE 1.—Panel test-fired bullets from the CE 139 rifle.

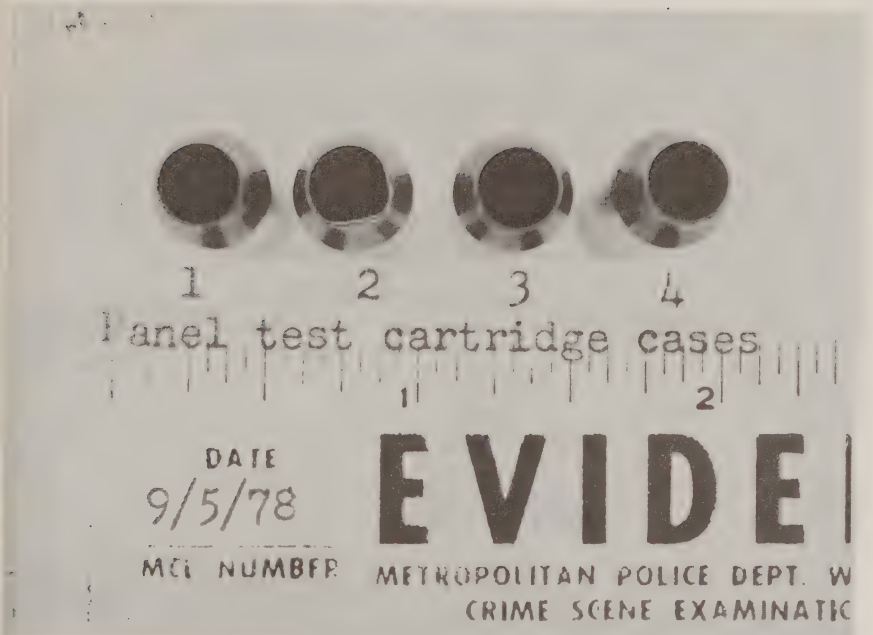


FIGURE 2.—Cartridge cases test-fired in the CE 139 rifle by the panel. Note the dent on the mouth of case No. 2, similar to the dent on the CE 543 cartridge case (see fig. 8B).



FIGURE 3A.—The CE 139 6.5-millimeter caliber Mannlicher-Carcano rifle, serial No. D2766, right side.





FIGURE 3B.—The CE 139 6.5-millimeter caliber Mannlicher-Carcano rifle, serial No. D2766, left side.

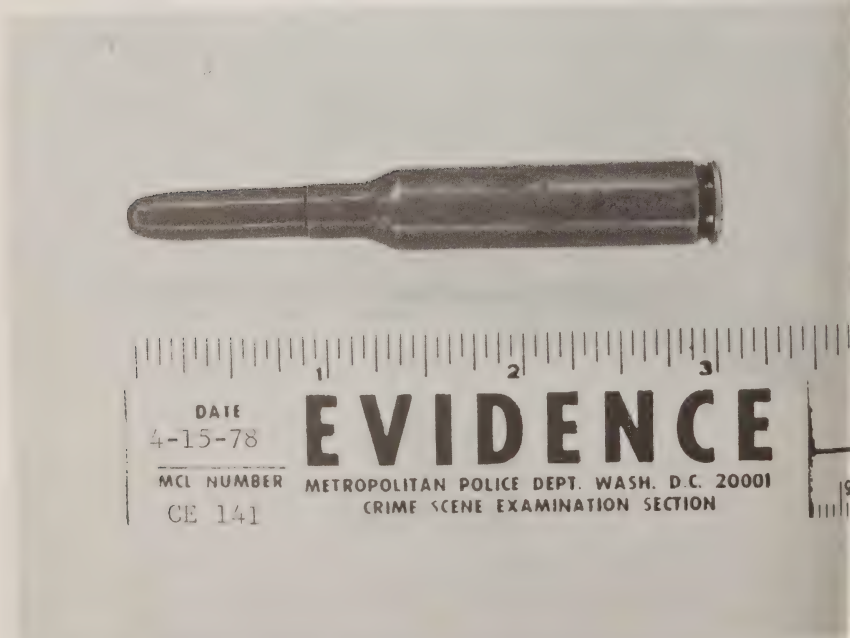


FIGURE 4.—CE 141, a 6.5-millimeter caliber cartridge of Western Cartridge Co. manufacture, found in the chamber of CE 139 rifle.

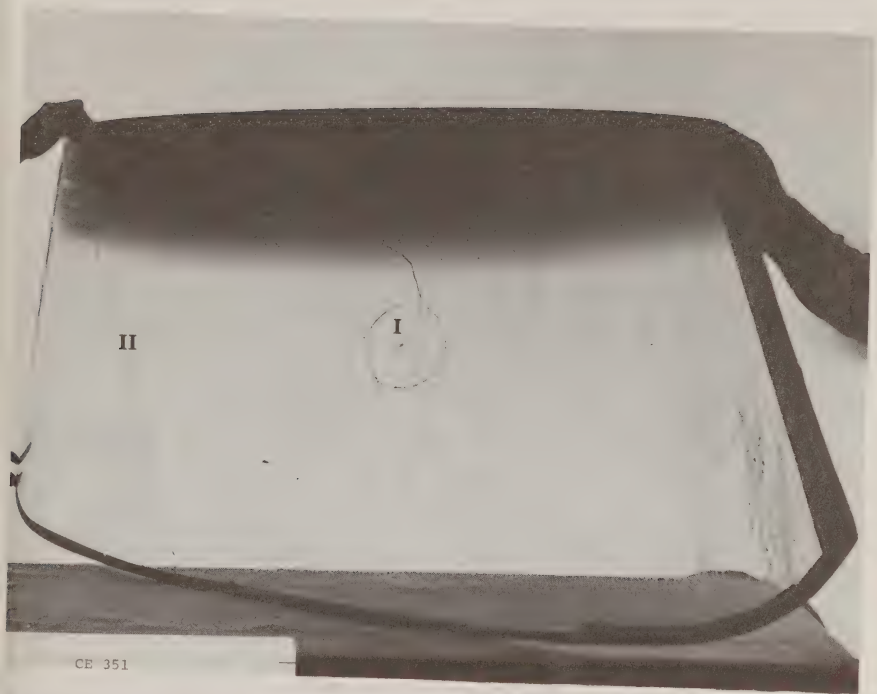
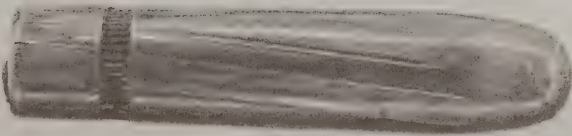


FIGURE 5.—Damaged CE 135 windshield removed from the Presidential limousine, front view.



C.E. 399 8/23/78



FIGURE 6A.—CE 399, the fired 6.5-millimeter caliber full metal-jacketed bullet found on a stretcher in the emergency area of Parkland Memorial Hospital, side view.

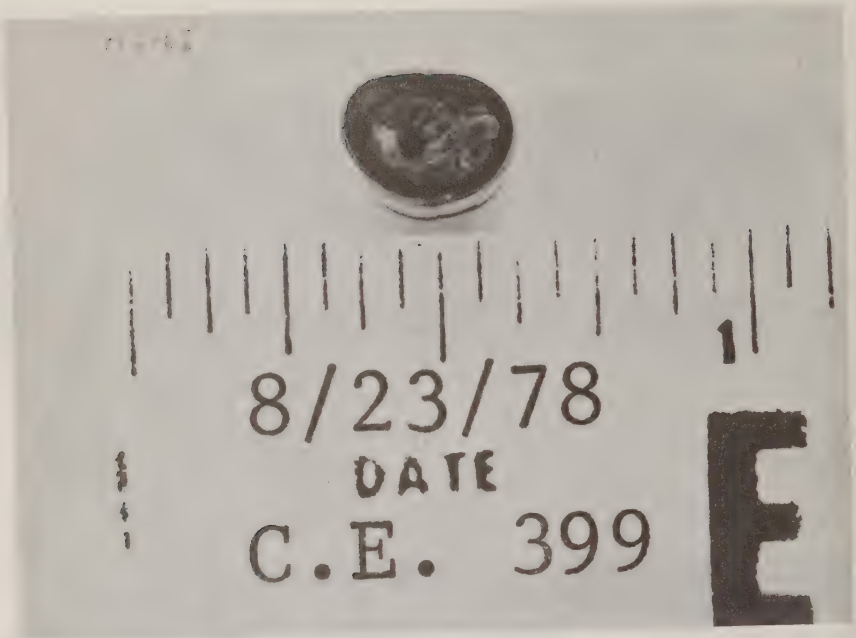
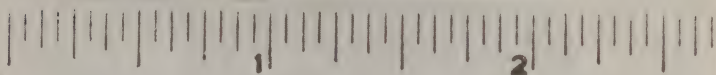
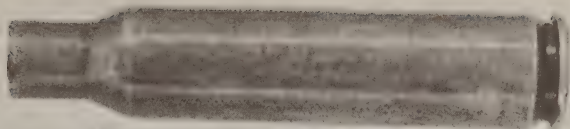


FIGURE 6B.—CE 399, the fired 6.5-millimeter caliber full metal-jacketed bullet found on a stretcher in the emergency area of Parkland Memorial Hospital, view of the base portion, showing distortion.



FIGURE 7.—CE 542, a 6.5-millimeter caliber Mannlicher-Carcano rifle, serial No. UC 5209, purchased by the FBI for comparison purposes.





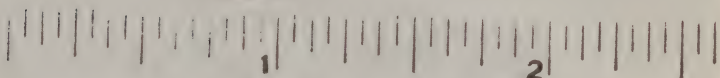
DATE  
4-15-78

**EVIDEN**

MCL NUMBER  
CE 543

METROPOLITAN POLICE DEPT. WASH  
CRIME SCENE EXAMINATION 5

FIGURE 8A.—CE 543, one of three expended 6.5-millimeter caliber cartridge cases of Western Cartridge Co. manufacture, recovered from the sixth floor of the Texas School Book Depository, side view.



DATE  
4-15-78

**EVIDEN**

MCL NUMBER  
CE 543

METROPOLITAN POLICE DEPT. WASH  
CRIME SCENE EXAMINATION 5

FIGURE 8B.—CE 543, one of three expended 6.5-millimeter caliber cartridge cases of Western Cartridge Co. manufacture, recovered from the sixth floor of the Texas School Book Depository, top view. Note the dent on the mouth of the case.

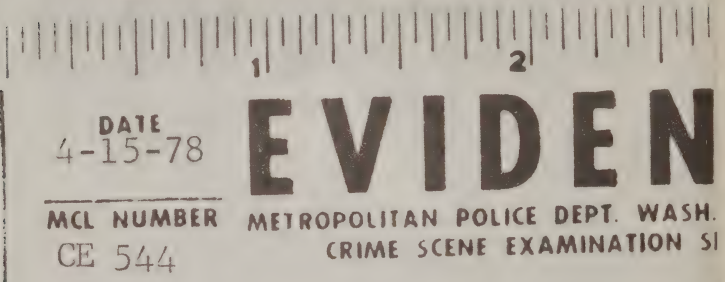
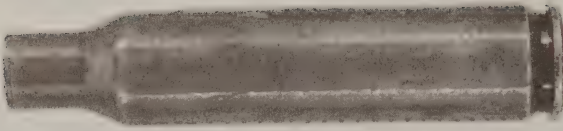


FIGURE 9.—CE 544, one of three expended 6.5-millimeter caliber cartridge cases of Western Cartridge Co. manufacture, recovered from the sixth floor of the Texas School Book Depository, side view.

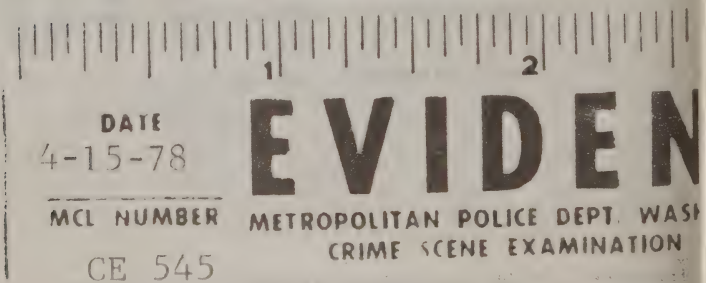
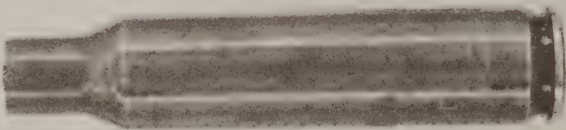


FIGURE 10.—CE 545, one of three 6.5-millimeter caliber cartridge cases of Western Cartridge Co. manufacture, recovered from the sixth floor of the Texas School Book Depository, side view.

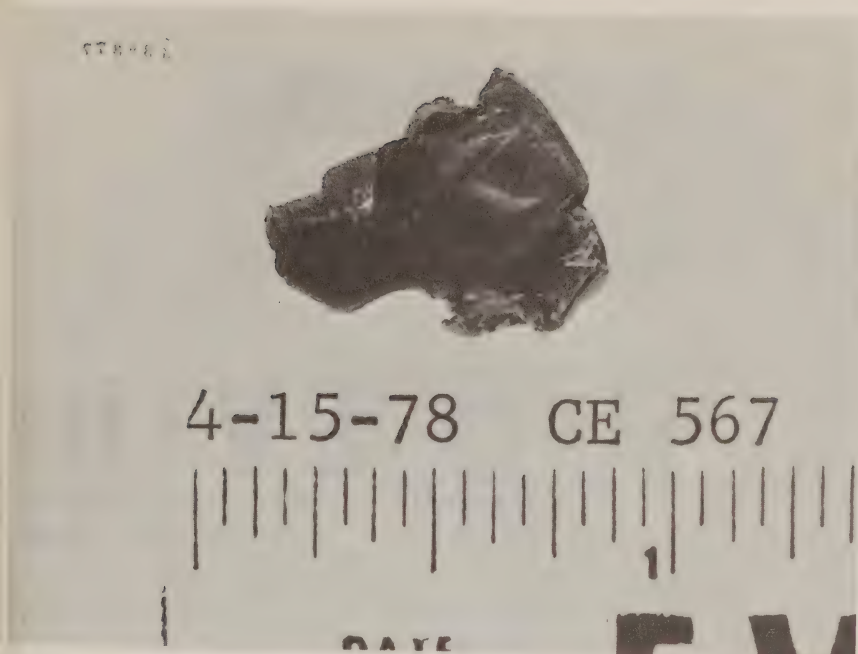


FIGURE 11.—CE 567, the nose portion of a fired 6.5-millimeter caliber metal-jacketed bullet found on the right side of the front seat of the Presidential limousine.

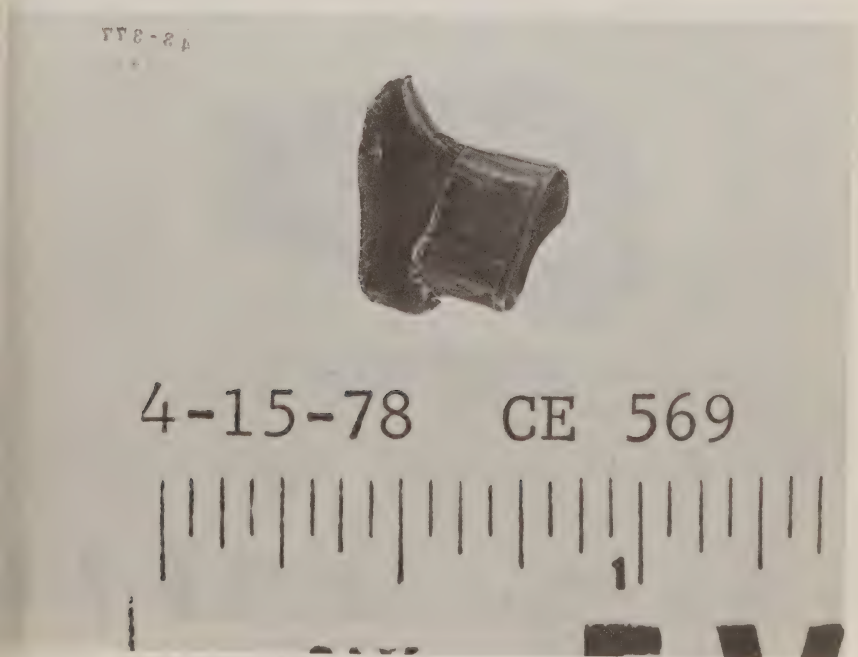


FIGURE 12.—CE 569, the base portion of a fired 6.5-millimeter caliber metal-jacketed bullet found on the floor next to the right front seat of the Presidential limousine.



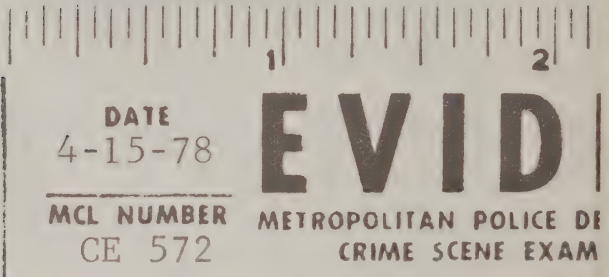
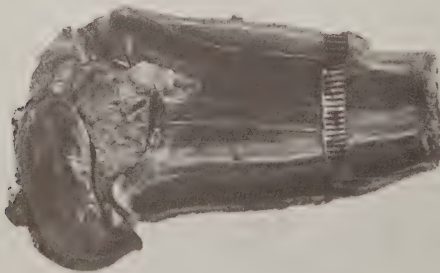


FIGURE 13.—CE 572, two fired 6.5-millimeter caliber full metal-jacketed bullets, test-fired by the FBI from the CE 139 rifle and designated as K1A and K1B.



4-15-78 CE 573



FIGURE 14.—CE 573, the 6.5-millimeter caliber metal-jacketed bullet recovered from the residence of General Edwin Walker.

776-81

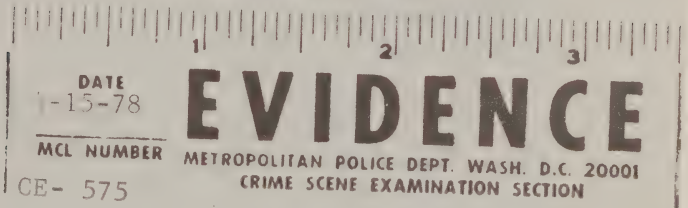


FIGURE 15.—CE 575, the brass cartridge clip removed from the CE 139 rifle.

776-81



4-15-78 CE 840

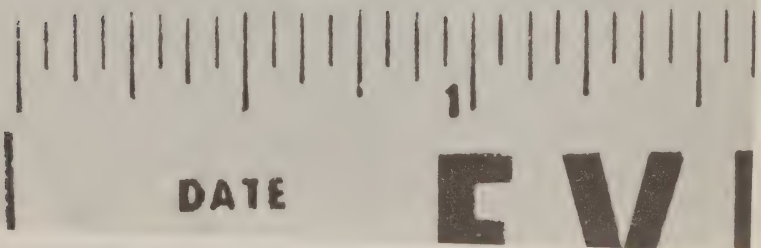


FIGURE 16.—CE 840, two lead-like fragments found underneath the left jump seat of the Presidential limousine.

DALLAS COUNTY HOSPITAL DIE...

FOREIGN BODY ENVELOPES

DATE: 4-15-78 TIME: 11:11

NAME: Gov. Connally

UNIT NUMBER: 11176

SEX-RACE: MALE

FOREIGN BODY Lead

AREA FROM WHICH REMOVED: Right arm

DOCTORS: Dr. Hargray

NURSES: Hyland, Anderson, Bell

CE 842  
11/24/78  
11/24/78  
11/24/78

8 CK NO

4-15-78 CE 842

DATE **EVIDENCE**

MCL NUMBER METROPOLITAN POLICE DEPT WASH. D.C. 20001  
CRIME SCENE EXAMINATION SECTION

FIGURE 17.—CE 842, four lead-like fragments, removed from Governor Connally

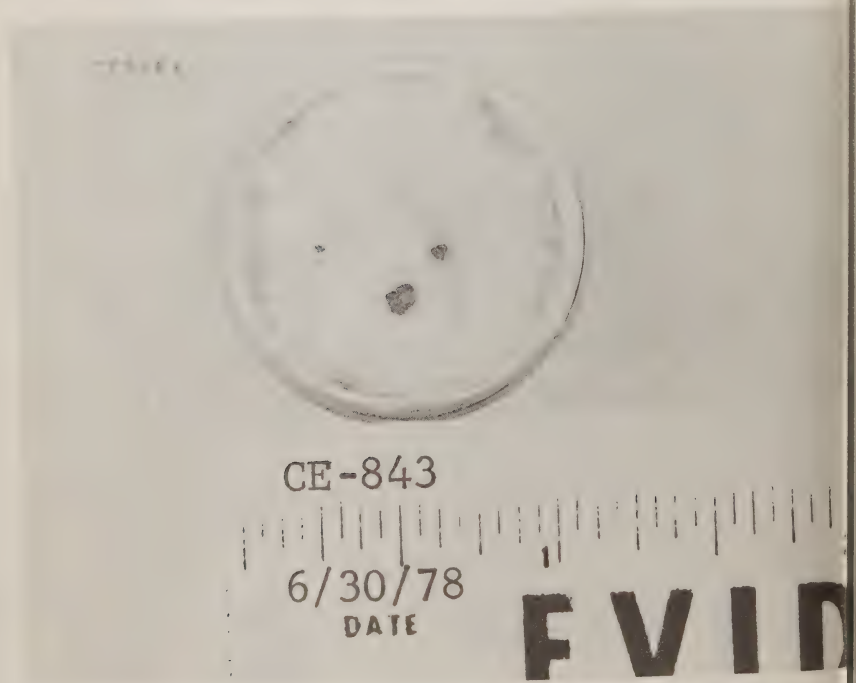
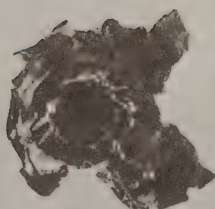


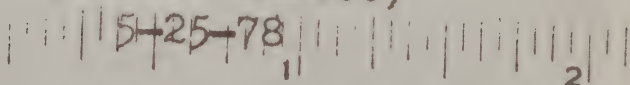
FIGURE 18.—CE 843, three lead-like fragments removed from President Kennedy brain during the autopsy.



878-24



C332 - Q632  
(Lester Bullet)

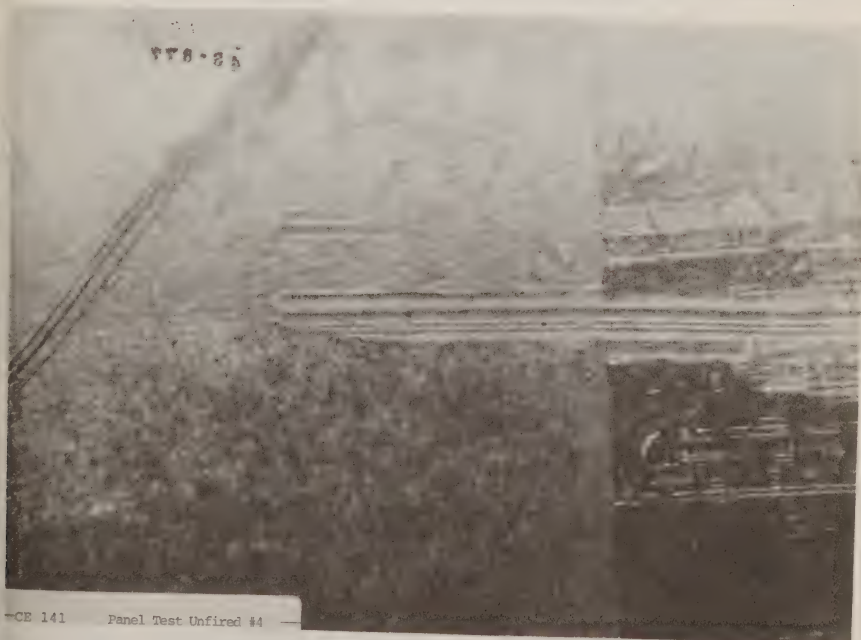


DATE

FBI

FIGURE 19.—The Lester bullet, a fired soft- or hollow-pointed, metal-jacketed bullet found in 1974 by Richard Lester about 500 yards from the depository near the Triple overpass.

878-25



—CE 141 Panel Test Unfired #4 —

FIGURE 20.—Photomicrograph showing the correspondence between the individual identifying characteristics on the side of the CE 141 cartridge (L) and on panel unfired test cartridge No. 4 (R), produced by the magazine follower of the CE 139 rifle.



FIGURE 21A.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 543 cartridge case (L) and on panel Kennedy T-1 (R), produced by the firing pin of the CE 139 rifle.



FIGURE 21B.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 543 cartridge case (L) and those of the panel Kennedy T-3 (R), produced by the extractor of the CE 139 rifle.

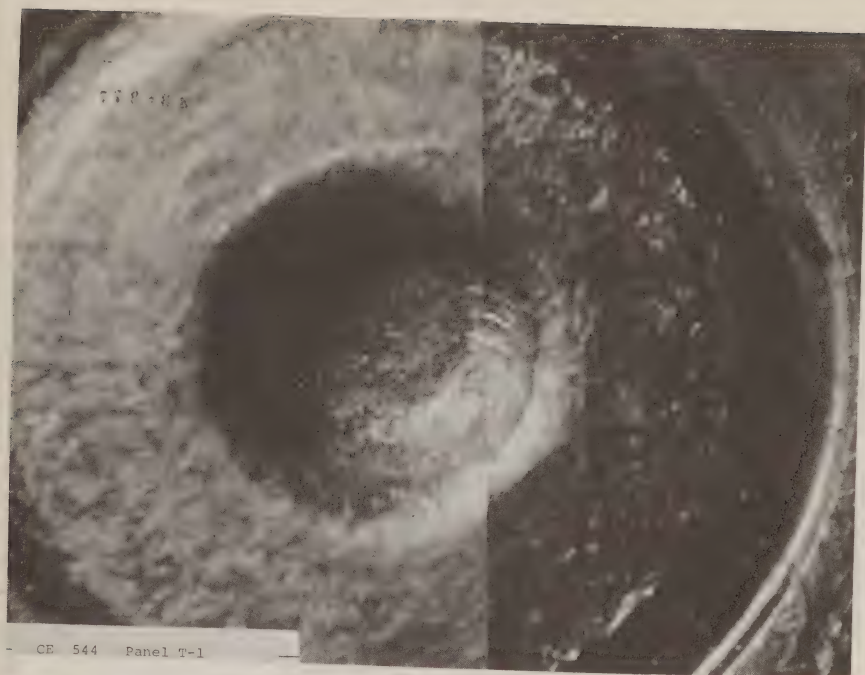


FIGURE 21C.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 544 cartridge case (L) and those on panel Kennedy T-1 (R), produced by the bolt face of the CE 139 rifle.



FIGURE 21D.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 545 cartridge case (L) and those on panel Kennedy T-3 (R), produced by the bolt face of the CE 139 rifle.





— CE 399 & CE 572 K1A

**FIGURE 22A.**—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 399 bullet (L) and those on CE 572-K1A bullet (R), test-fired by the FBI in the CE 139 rifle.



**FIGURE 22B.**—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 399 bullet (L) and those on the CE 572-K1A bullet (R), test-fired by the FBI in the CE 139 rifle.



FIGURE 23A.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 567 bullet fragment (L) and those on CE 572-K1A (R), test-fired by the FBI in the CE 139 rifle.



FIGURE 23B.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 567 bullet fragment (L) and those on CE 572-K1B (R), test-fired by the FBI in the CE 139 rifle.



FIGURE 24A.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 569 bullet fragment (L) and CE 572-K1A bullet (R), test-fired by the FBI in CE 139 rifle.



FIGURE 24B.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 569 bullet fragment (L) and the CE 572-K1B bullet (R), test-fired by the FBI in the CE 139 rifle.



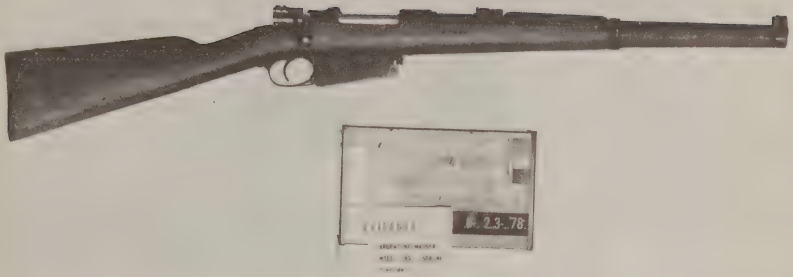


FIGURE 25.—A 7.65-millimeter caliber Argentine Mauser rifle, Model 1891.

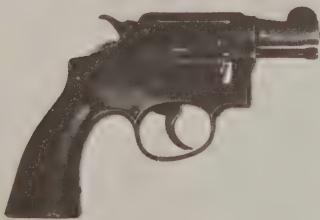


FIGURE 26A.—CE 143. Oswald's .38 special caliber Smith and Wesson revolver, Victory model, serial No. V510210, right side.

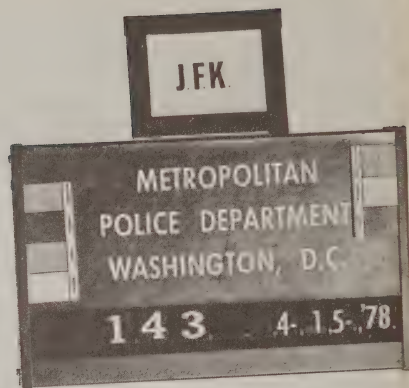
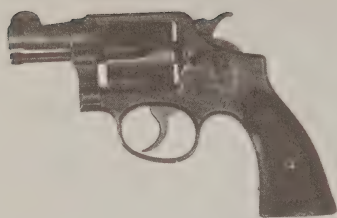
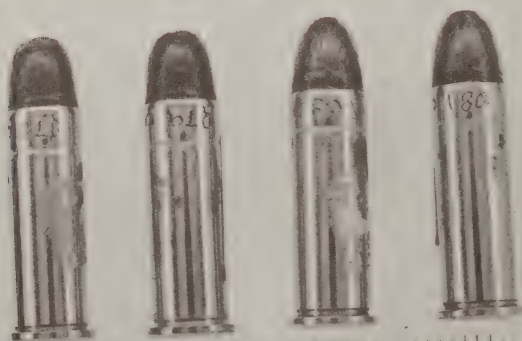


FIGURE 26B.—CE 143, Oswald's .38 special caliber Smith and Wesson revolver, Victory model, serial No. V510210, left side.



DATE  
4-15-78

**EVIDENCE**

MCL NUMBER METROPOLITAN POLICE DEPT. WASH. D.C. 20001  
CRIME SCENE EXAMINATION SECTION

CE 518 Q78, Q79, Q80, Q81

FIGURE 27.—CE 518, four .38 special caliber cartridges, designated Q78–Q81 by the FBI, found in Oswald's revolver. Q78 and Q79 have copper-coated (Lubaloy), lead, round-nose bullets; Q80 and Q81 have plain lead, round-nose bullets.

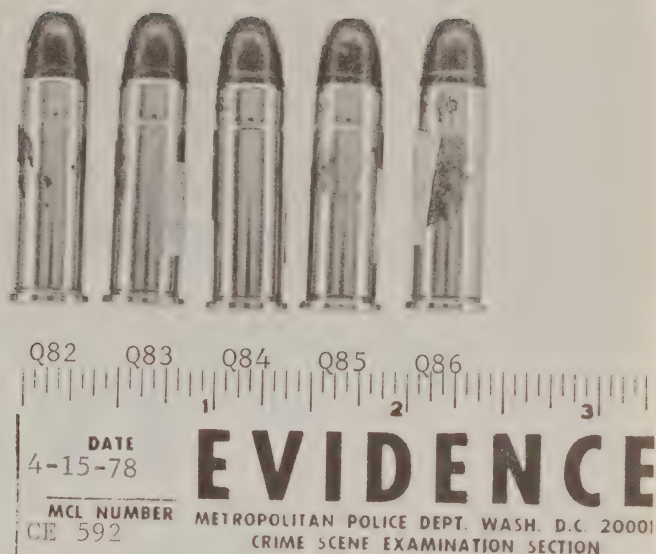


FIGURE 28.—CE 592, five .38 special caliber cartridges of Western Cartridge Co. manufacture, with copper-coated (Lubaloy), lead, round-nose bullets, designated Q82-Q86 by the FBI. The cartridges were found in Oswald's trouser pocket.

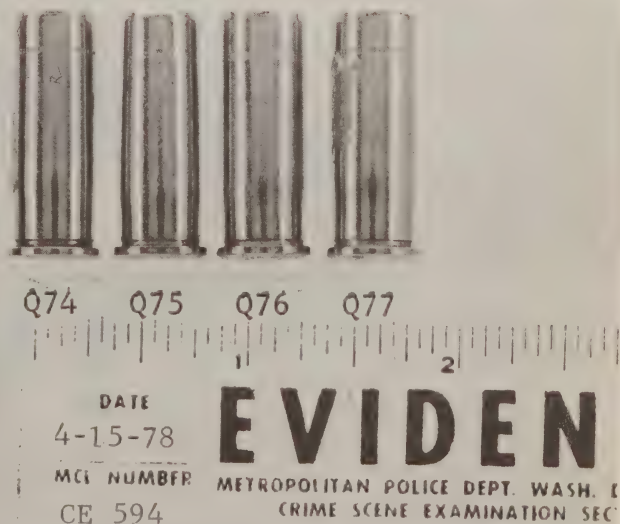
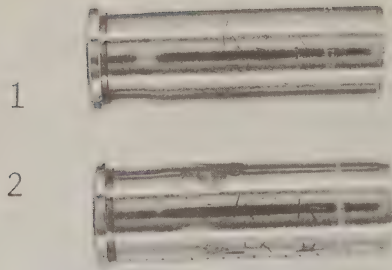


FIGURE 29.—CE 594, four expended cartridge cases recovered from the scene of the Tippit murder, designated Q74-Q77 by the FBI. Q75 and Q76 of Western Cartridge Co. manufacture, Q74 and Q77 are of Remington Arms manufacture.



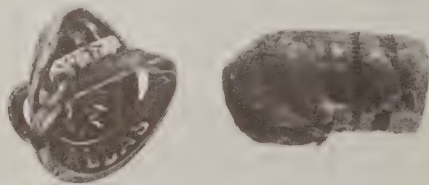


DATE  
4-15-78

MCL NUMBER  
CE 595

**EVIDENCE**  
METROPOLITAN POLICE DEPT. W  
CRIME SCENE EXAMINATION

FIGURE 30.—CE 595, two cartridge cases, test-fired by the FBI in the CE 143 revolver. K3-1 is .38 special caliber of Winchester Repeating Arms manufacture. K3-2 is of Western Cartridge Co. manufacture; it has a split in the side, at the point of the bulge along the top side of the case.



DATE  
4-15-78

MCL NUMBER  
CE 602

**EVIDENCE**  
METROPOLITAN POLICE DEPT. W  
CRIME SCENE EXAMINATION

FIGURE 31.—CE 602, one .38 special caliber copper-coated (Lubaloy), lead, round-nose bullet, and one damaged brass-colored garment button with the lettering "City of Dallas," removed from the body of Officer Tippit. The bullet shows impact damage caused by striking the button and Officer Tippit's body.



4-15-78 CE 603

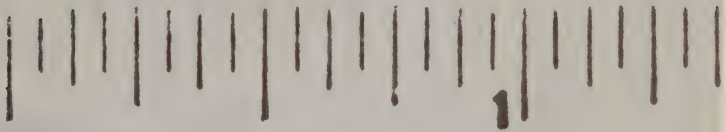
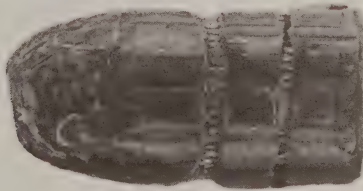


FIGURE 32.—CE 603, one .38 special caliber copper-coated (Lubaloy), lead, round-nose bullet, removed from the body of Officer Tippit.



4-15-78 CE 604

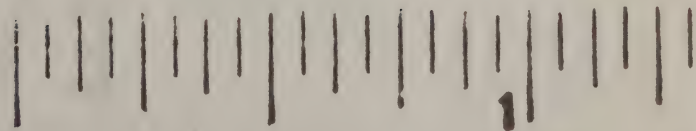
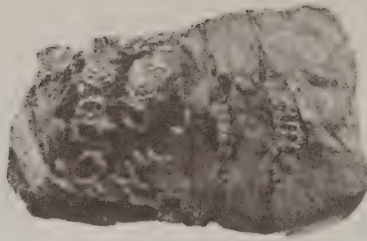


FIGURE 33.—CE 604, one .38 special caliber lead, round-nose bullet, removed from the body of Officer Tippit.



4-15-78 CE 605

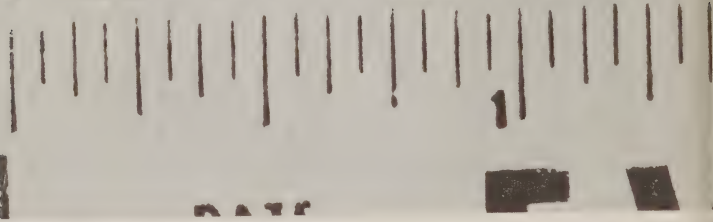


FIGURE 34.—CE 605, one .38 special caliber copper-coated (Lubaloy), lead, round-nose bullet, removed from the body of Officer Tippit.



Panel Test

T-1 Lead

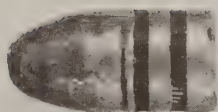
5-25-78  
DATE

**EVII**

MCL NUMBER METROPOLITAN POL  
CRIME SCENE

FIGURE 35A.—Panel Tippit T-1: One .38 special caliber lead bullet of Remington-Peters manufacture, test-fired from CE 139 by the panel into a horizontal water recovery tank.





Panel Test  
T-2 Lead

5-25-'78  
DATE

**EVID**

MCI NUMBER METROPOLITAN POLICE

FIGURE 35B.—Panel Tippit T-2: one .38 special caliber lead bullet of Remington-Peters manufacture, test-fired from CE 143 by the panel into a horizontal water recovery tank.



Panel Test  
T-3 Lubaloy

5-25-'78  
DATE

**EVII**

MCI NUMBER METROPOLITAN POLICE  
CRIME SCENE

FIGURE 35C.—Panel Tippit T-3: 1 .38 special caliber copper-coated (Lubaloy), lead, round-nose bullet of Western Cartridge Co. manufacture, test-fired from CE 143 by the panel into a horizontal water recovery tank.



Panel Test

T-4 Lubaloy

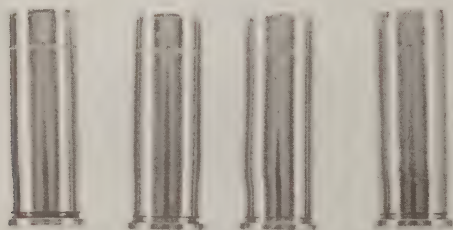
5-25-'78  
DATE

**EVID**

MCI NUMBER

METROPOLITAN POLICE  
CRIME SCENE EXAMINATION SECTION

FIGURE 35D.—Panel Tippit T-4: 1 .38 special caliber copper-coated (Lubaloy), lead, round-nose bullet of Western Cartridge, Co. manufacture, test-fired from CE 143 into a horizontal water recovery tank.



T-1 T-2 T-3 T-4

Panel Test Cartridge Cases

5-25-'78  
DATE

**EVIDENCE**

MCI NUMBER

METROPOLITAN POLICE DEPT. WASH. D.C. 20001  
CRIME SCENE EXAMINATION SECTION

FIGURE 35E.—Panel Tippit T-1—T-4: Four expended .38 special caliber cartridge cases. Tippit T-1 and T-2 are of Remington-Peters manufacture; Tippit T-3 and T-4 are of Western Cartridge Company; all are fired in the CE 143 revolver.

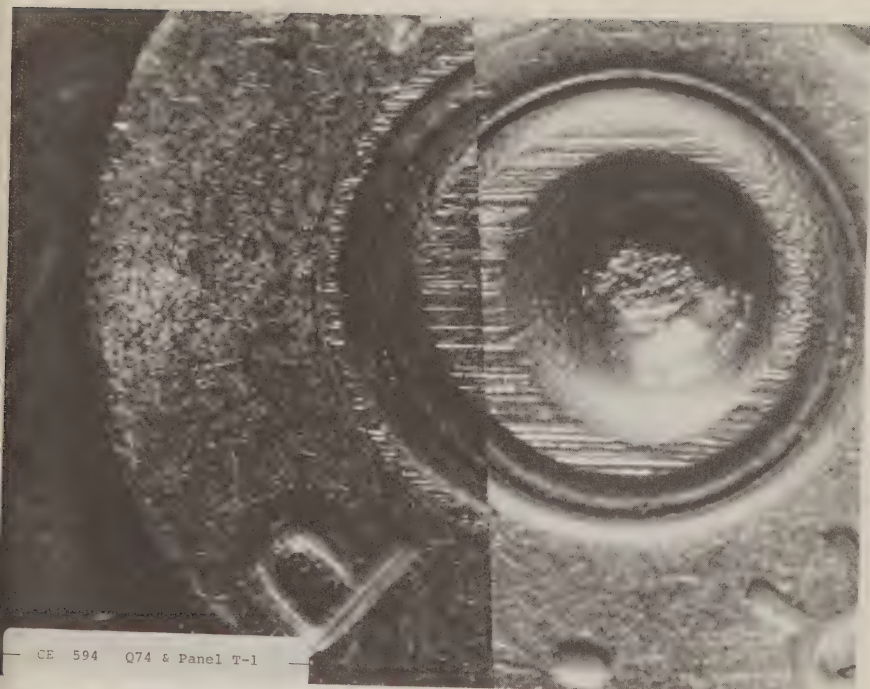


FIGURE 36A.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 594 (Q74) cartridge case (L) and the panel Tippit T-1 cartridge case (R), produced by the breech face of the CE 143 revolver.

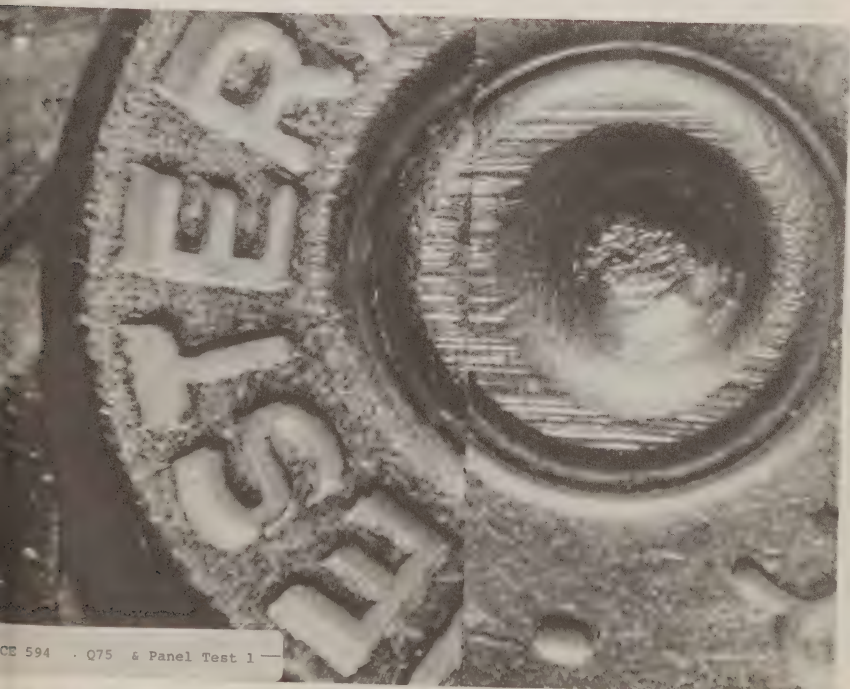


FIGURE 36B.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 594 (Q75) cartridge case (L) and the panel Tippit T-1 cartridge case (R), produced by the breech face of the CE 143, revolver.



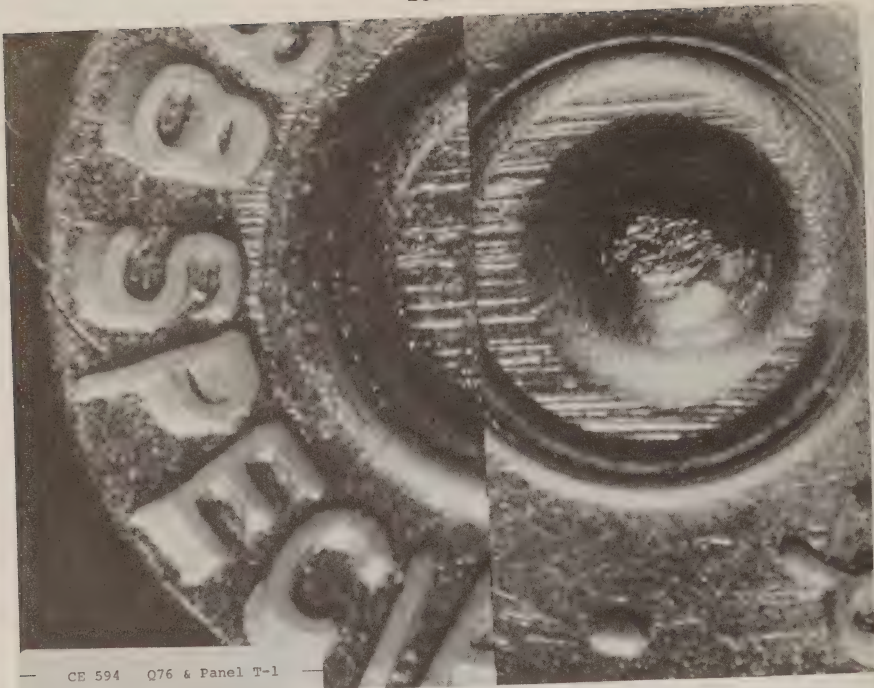
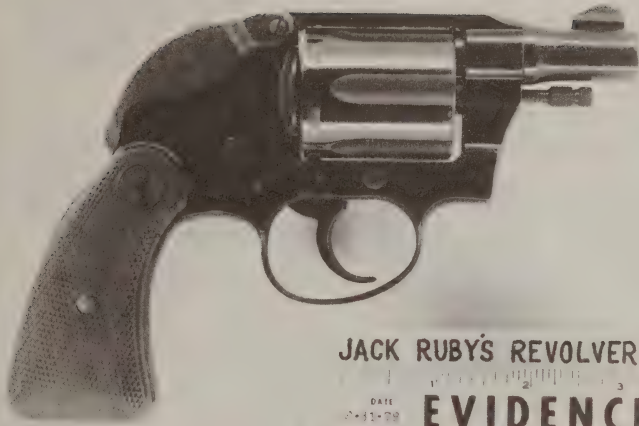


FIGURE 36C.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 594 (Q76) cartridge case (L) and the Tippit T-1 cartridge case (R), produced by the breech face of the CE 143 revolver.



FIGURE 36D.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 594 (Q77) cartridge case (L) and the panel Tippit T-1 cartridge case (R) produced by the breech face of the CE 143 revolver.



JACK RUBY'S REVOLVER

DATE

2-11-68

**EVIDENCE**

METROPOLITAN POLICE DEPT. WASH. D.C. 20001  
CRIME SCENE EXAMINATION SECTION

FIGURE 37A.—Ruby's .38 special caliber Colt Cobra revolver, serial. No. 2744 LW, right side.



JACK RUBY'S REVOLVER

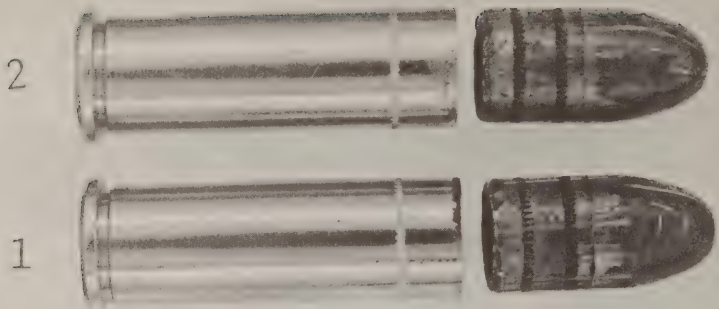
DATE

2-11-68

**EVIDENCE**

METROPOLITAN POLICE DEPT. WASH. D.C. 20001  
CRIME SCENE EXAMINATION SECTION

FIGURE 37B.—Ruby's .38 special caliber Colt Cobra revolver, serial No. 2744, LW, left side.



J. RUBY

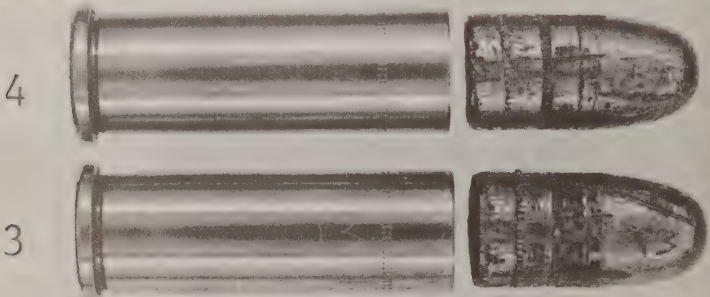
TEST #1 &amp; 2

9-6-78

DATE

EVID

FIGURE 38A.—Panel Ruby T-1 and T-2: Two .38 special caliber cartridges of Remington-Peters manufacture, with 158-grain, lead, round nose bullets, test-fired by the panel from Jack Ruby's revolver into a horizontal recovery tank.



J. RUBY

TEST #3 &amp; 4

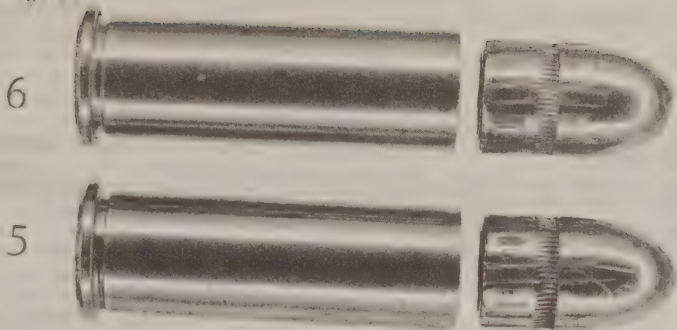
9-6-78

DATE

EVID

FIGURE 38B.—Panel Ruby T-3 and T-4: Two .38 special caliber cartridges of Western Cartridge Co. manufacture, with 158-grain, copper-coated (Lubaloy), lead, round nose bullets, test-fired from the Jack Ruby's revolver into horizontal recovery tank.





J. RUBY

TEST #5 &amp; 6

9-6-78

DATE

**EVIDENCE**

FIGURE 38C.—Panel Ruby T-5 and T-6: Two .38 special caliber cartridges of Remington Arms Co. manufacture, with 130-grain, full metal-jacketed, round nose bullets, test-fired by the panel from Jack Ruby's revolver into a horizontal water recovery tank.

## GLOSSARY

- Action:** The heart of any firearm. It consists of the receiver, bolt or breech block, feed and firing and unloading mechanisms.
- Bearing Surface:** That part of the outside surface of a bullet which comes in contact with the rifling as it passes through the barrel.
- Bolt Face:** That portion of a rifle's bolt which engages the cartridge case head and from which the firing pin protrudes when the rifle is fired.
- Bore:** The interior of the barrel of a firearm.
- Breech Face:** In revolvers, the area of the frame which supports the cartridge case head and through which the firing pin protrudes when the revolver is fired.
- Breech Face Impressions:** When a cartridge is fired, the burning gases exert pressures that force the base of the cartridge back against the bolt or breech face. When this occurs, the tool marks that are present on the bolt or breech face are imprinted on the flat areas of the contacting surfaces of the primer and cartridge case base.
- Bullet:** That part of a cartridge intended to be fired from the barrel of a firearm. It is usually composed of lead, plated lead or lead encased in a metal jacket.
- Cannelure:** A knurled or plain ring around the bearing surface of a bullet, used to hold surface lubricant, retain the bullet in the cartridge case or identify the type or weight of bullet. Cannelures may also be found on cartridge cases.
- Cartridge:** A complete assembly of a round of ammunition consisting of the case, primer, propellant powder, and bullet.
- Cartridge Case:** That part of a cartridge which holds the bullet, primer, and propellant powder together.
- Cartridge Clip:** A device for holding a number of cartridges to permit their easy insertion into a magazine. The Mannlicher-Carcano clip remains in the magazine until after the last cartridge is fed into the chamber, at which time it is designed to fall through the bottom opening of the magazine.
- Chamber:** In a rifle, the rear portion of the barrel, designed to hold and support a cartridge. In a revolver, it is also the recess cut into the cylinder to hold each cartridge.
- Chambering:** The manual or mechanical process of feeding a cartridge into the chamber of a firearm.
- Comparison Microscope:** A scientific instrument designed to allow the similarity, or dissimilarity, of individual identifying characteristics of two bullets or two cartridge cases to be observed at the same time.
- Cylinder:** A rotating cartridge container in a revolver.
- Double Action:** The mode of firing a revolver in which the hammer of the firearm is cocked and released by a single pull of the trigger.
- Eject:** The act of throwing the expended cartridge case clear of the action during the firing process.
- Emission Spectrography:** Allows the metallic composition of samples to be compared so that the possibility of common origin can be determined. This is done by subjecting the material to intense heat and comparing the color of gases emitted.
- Extract:** The process of withdrawing an expended cartridge case or unfired cartridge from the chamber of a firearm, either by mechanical or manual means.
- Firearms Identification:** A study of firearms, bullets, cartridge cases and other ammunition components with the purpose of identifying those ammunition components as having been fired from, or in, a particular firearm to the exclusion of all other firearms.
- Firing Pin:** That part of a firing mechanism which strikes the primer.
- Firing Pin Impression:** The indentation caused by the firing pin striking the primer of the cartridge case.
- Gas Erosion:** The wear caused by the action of the hot propellant powder gases on the bearing surface of a bullet.

- Grooves:** The depressed areas between the lands of a rifled barrel.
- Horizontal Cotton Recovery Box:** A box, filled with cotton material, designed to recover fired bullets in an undamaged condition.
- Horizontal Water Recovery Tank:** A metal, water-filled tank designed to recover fired bullets in an undamaged condition.
- Individual Identifying Characteristics:** Unique reproducible microscopic marks which can be used to identify a fired bullet or expended cartridge case with a particular firearm.
- Lands:** The raised areas between the grooves of a rifled barrel.
- Loading Ramp:** A device that aids in guiding a cartridge into the chamber of a firearm.
- Magazine:** A device, either separate or integral to the firearm, in which cartridges are held in position to be fed into the chamber of the firearm.
- Magazine Follower:** (In footnotes).
- Microscopic Examination:** An examination of evidence which is enhanced by the use of scientific instruments.
- Muzzle:** The forward end of the barrel where the bullet exits.
- Neutron Activation Analysis:** A method of nuclear elemental analysis in which samples are irradiated to make their various elements detectable by radioactive measurement. The elemental composition of the activated samples is then compared to determine the probability of common origin.
- Photomicrograph:** Photograph taken through a microscope.
- Primer:** The ignition part of a cartridge.
- Rechambering:** The process of altering the dimensions of a chamber to accommodate other cartridges.
- Recrowning:** The process of restoring the rounded contour to the muzzle after the barrel has been shortened.
- Reset:** (See footnotes).
- Rifling:** The spiral lands and grooves in a barrel which impart spin or rotation to the bullet stabilizing it in flight.
- Rifling Class Characteristics:** The number, width and direction of twist of the lands and grooves in a barrel.
- Sear Mechanism:** The part or device designed to hold the firing mechanism in a cocked position until released by pressure on the trigger.
- Secondary Missiles:** Objects put in motion due to the impact of a bullet.
- Single Action:** The mode of firing a revolver that requires that the hammer be manually cocked before it can be fired.
- Spectrographic Analysis:** See "Emission Spectrography".
- Striations:** Minute grooves, ridges or scratches normally running parallel with each other that are caused by an abrasive action.
- Tool Mark:** Characteristics of a surface imparted to a softer surface when they come in contact under pressure and motion. Tool marks may be impressed or engraved.
- Trigger Pull:** The amount of force, expressed in pounds, required to release the firing mechanism.
- Twist:** The spiral direction of lands and grooves in a rifled bore, expressed as right or left.
- Visual Examination:** Examination of evidence without the assistance of a scientific instrument; also referred to as macroscopic examination.
- Wiping:** The removal of some of the fine microscopic scratches on a bullet, particularly the lead variety, as it enters and passes through fabric, heavy tissue and muscle.



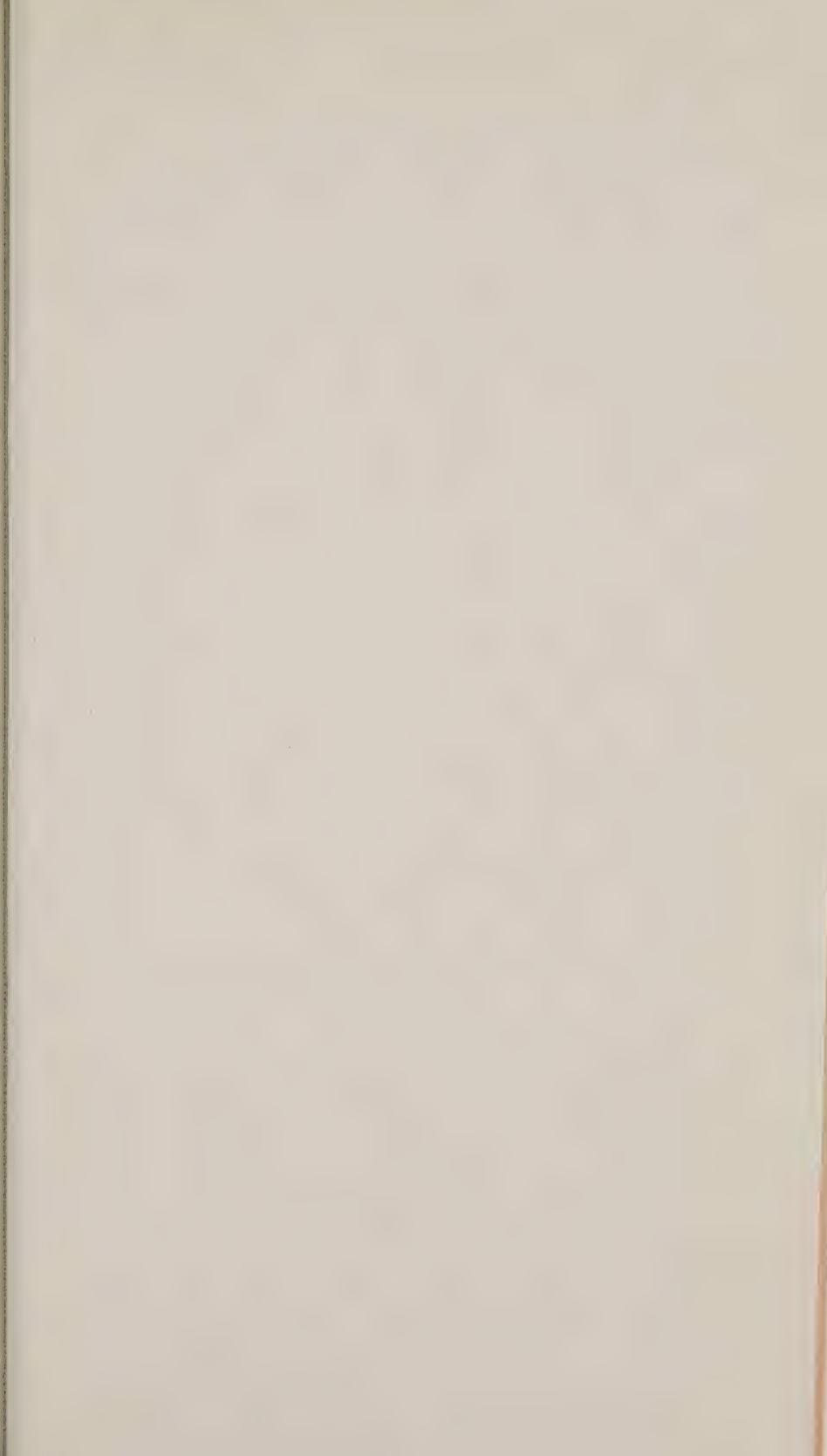
## REFERENCES

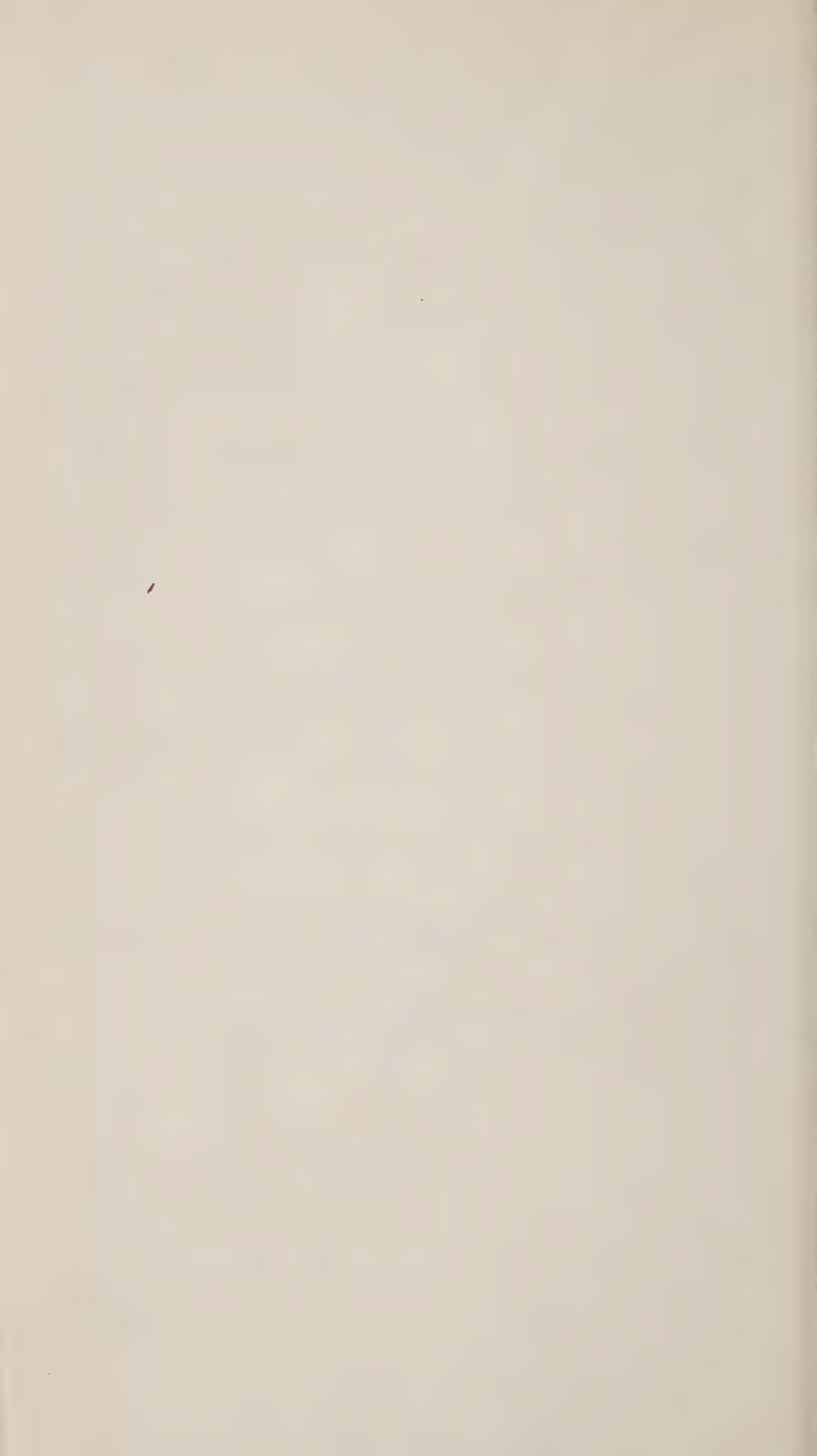
- (1) Report of the President's Commission on the Assassination of President Kennedy (Washington, D.C.: U.S. Government Printing Office, 1964), p. 79 (hereinafter cited as the Warren report).
- (2) Hearings before the President's Commission on the Assassination of President Kennedy (Washington, D.C.: U.S. Government Printing Office, 1964), vol. 4, p. 254 (hereinafter cited as WCH vol. No.).
- (3) WCH, vol. 3, p. 414.
- (4) Warren report, p. 79.
- (5) WCH, vol. 3, p. 293.
- (6) Ibid.
- (7) WCH, vol. 24, p. 228.
- (8) WCH, vol. 4, p. 260.
- (9) Id. at p. 258.
- (10) FBI report, Sept. 10, 1964 (JFK Document No. 010141).
- (11) Warren report, p. 165.
- (12) WCH, vol. 3, p. 476.
- (13) Ibid.
- (14) Id. at p. 465.
- (15) Id. at p. 474.
- (16) Id. at p. 301.
- (17) Ibid.
- (18) Id. at p. 460.
- (19) Id. at p. 459.
- (20) Id. at p. 460.
- (21) WCH, vol. 3, p. 301.
- (22) HSCA deposition of Nathan B. Pool, July 12, 1978 (JFK Document 010022), p. 29.
- (23) Ibid.
- (24) WCH, vol. 3, p. 428.
- (25) Warren report, pp. 88 and 93.
- (26) WCH, vol. 5, p. 72.
- (27) Ibid.
- (28) Id. at p. 73.
- (29) Id. at p. 66.
- (30) Id. at p. 67.
- (31) Ibid.
- (32) Id. at p. 66.
- (33) Ibid.
- (34) WCH, vol. 3, p. 435.
- (35) WCH, vol. 4, p. 273.
- (36) WCH, vol. 3, p. 452.
- (37) WCH, vol. 13, p. 8.
- (38) HSCA outside contract report, William Alexander, Dec. 7, 1978 (JFK Document No. 013566).
- (39) HSCA outgoing correspondence, Jules Mayer (JFK Document 009087).
- (40) See reference 38.
- (41) WCH, vol. 3, p. 497.
- (42) Warren report, p. 85.
- (43) WCH, vol. 5, pp. 67, 73, and 74.
- (44) Warren report, p. 85.
- (45) Ibid.
- (46) Id. at p. 562.
- (47) Ibid.
- (48) Warren report, p. 559.
- (49) Ibid.
- (50) Warren report, p. 559.
- (51) Ibid.

- (52) HSCA staff interview of Richard Lester, Nov. 10, 1977 (JFK Document No. 003534).
- (53) FBI report, Aug. 2, 1977, p. 1-2 (JFK Document No. 001931).
- (54) Ibid.
- (55) Ibid.
- (56) Ibid.
- (57) See reference 52.
- (58) Ibid.
- (59) HSCA outside contact report, Bill Mason, Apr. 20, 1977 (JFK Document No. 001285).
- (60) Ibid.
- (61) Edward Jay Epstein, "Inquest" (New York: the Viking Press, 1966), p. 79.
- (62) Mark Lane, "Rush to Judgment" (New York: Holt, Reinhardt and Winston, 1966), pp. 78-79.
- (63) Robert Sam Anson, "They've Killed the President" (New York: Bantam Books, 1975), p. 76.
- (64) Ibid.
- (65) Sylvia Meagher, "Accessories After the Fact" (New York: Random House, 1976), p. 103.
- (66) Ibid.
- (67) Josiah Thompson, "Six Seconds in Dallas" (New York: Berkeley Medalion Books, 1976), p. 193.
- (68) Ibid.
- (69) See reference 62, p. 114.
- (70) Incoming correspondence, National Archives, Dec. 13, 1977 (JFK Document No. 004053).
- (71) The "CE" designations of the Warren Commission were used by the panel.
- (72) The panel noted that Warren Commission determined the weight of CE 399 to be 158.6 grains (Warren report, p. 95). The National Archives also weighed CE 399, at the request of the committee and the panel, on Dec. 14, 1978, and found its weight to be 157.7, the same as the panel's finding (HSCA outside contact report, Robert MacClaren, Dec. 14, 1978, JFK Document No. 013672).
- (73) HSCA incoming correspondence, National Archives, July 8, 1970 (JFK Document No. 010170).
- (74) WCH, vol. 5, p. 61.
- (75) Over 100 rounds of ammunition were fired in the CE 139 rifle. Warren report, p. 193.
- (76) Ibid.
- (77) Ibid.
- (78) Joseph E. Smith and S. H. B. Smith, "Small Arms of the World." (City Stackpole Books, 1969), p. 475. Also see: Joseph E. Smith and W. H. B. Smith, "Book of Rifles." (Harrisburg, Pa.: Stackpole Books, 1963), pp. 301-302.
- (79) See reference 67.
- (80) See reference 72.
- (81) H. P. White and Burton D. Munhall, "Center Fire American and British Pistol and Revolver Cartridges," (Washington, D.C.: Combat Forces Press, 1950), (JFK Document No. 010739).
- (82) Ibid.
- (83) Ibid.













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# INVESTIGATION OF THE ASSASSINATION OF PRESIDENT JOHN F. KENNEDY

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## APPENDIX TO HEARINGS

BEFORE THE

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OF THE

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NINETY-FIFTH CONGRESS

SECOND SESSION

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#### VOLUME VIII

ACOUSTICS, POLYGRAPH, HANDWRITING, AND FINGERPRINT  
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(II)

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A STUDY OF THE ACOUSTICS EVIDENCE RELATED TO  
THE ASSASSINATION OF PRESIDENT JOHN F. KENNEDY

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Report to the  
Select Committee on Assassinations  
U.S. House of Representatives  
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# AN ANALYSIS OF RECORDED SOUNDS RELATING TO THE ASSASSINATION OF PRESIDENT JOHN F. KENNEDY\*

(Prepared for Select Committee on Assassinations, U.S. House of Representatives, by Mark R. Weiss and Ernest Aschkenasy, Department of Computer Science, Queens College, City University of New York, February 1979)

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\*Materials submitted for this report by the committee's acoustics panel were compiled by HSCA staff member Gary T. Cornwell.

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## FOREWORD

On September 11, 1978, Dr. James Barger of Bolt Beranek and Newman, Inc. (BBN) presented to the House Select Committee on Assassinations the results of a BBN analysis of a Dallas Police Department (DPD) recording that had been made on November 22, 1963. One of the reported findings was that, with a probability of 50 percent, the recording contains sounds of a gunshot, or at least sounds as loud as a gunshot, fired from the so-called grassy knoll area of Dealey Plaza in Dallas; they were received by a microphone on a DPD motorcycle that was moving on Elm Street at a speed of about 11 mph in the same direction as the Presidential motorcade. On October 24, 1978, the committee authorized the authors of this report to conduct an independent examination of that portion of the recording to determine with more certainty whether the sounds in question were of such a shot. The analysis was completed by the middle of December 1978 and described in a public presentation to the committee on December 29, 1978. This report describes the method and results of that analysis.

## 1.0 INTRODUCTION AND SUMMARY

## 1.1 Background

On November 22, 1963, in Dallas, Tex., at the time that shots were being fired in the assassination of President John F. Kennedy, a radio on a Dallas Police Department (DPD) motorcycle that apparently had a stuck microphone was transmitting sounds over channel 1 of the DPD radio network that were being recorded at DPD headquarters. In an analysis of this recording, authorized by the House Select Committee on Assassinations, Dr. James Barger and his colleagues at Bolt Beranek and Newman, Inc. (BBN) isolated four groups of sound impulses and identified them as probable sounds of gunshots, and not merely random noise. They calculated that the statistical probabilities that these identifications were correct were, in order of increasing time of occurrence of the sounds, 88 percent, 88 percent, 50 percent, and 75 percent. BBN found that the probable cause of the first, second, and fourth of these groups of impulses were noises as loud as gunshots originating in the vicinity of the sixth floor southeast corner window of the Texas School Book Depository (TSBD) in Dealey Plaza. The probable cause of the third group of impulses was a similarly loud sound from the vicinity of the so-called grassy knoll area of Dealey Plaza. BBN also found that all of the groups of sounds were picked up by a microphone on a DPD motorcycle and that at the time of the third probable gunshot, the motorcycle was on Elm Street in Dealey Plaza, moving at a speed of about 11 miles per hour in the same direction as the motorcade. On October 24, 1978, the committee authorized the authors of this report to perform an independent examination of the sounds on the DPD recording to determine with a higher level of certainty if the third group of impulses was caused by the sounds of a gunshot from the grassy knoll.

## 1.2 Materials provided for the examination

At the time we began our analyses, we were provided with the following materials:

1. A high-fidelity tape-recorded copy of the original DPD recording.
  2. A high-fidelity tape-recorded copy of the DPD tape recording that had been examined by BBN.
  3. A high-fidelity tape-recorded copy of the sounds of gunshots that were recorded by BBN during an acoustical reconstruction experiment conducted in Dealey Plaza on August 20, 1978.
  4. A topographical survey map of Dealey Plaza, plotted at a scale of 1 inch equal to 10 feet.
  5. A map of Dealey Plaza, plotted at a scale of 1 inch equal to 40 feet, on which the locations of microphones used in the reconstruction experiment were indicated.
  6. Aerial and ground level photographs of Dealey Plaza and relevant surrounding structures.
- In addition, the committee staff provided to us various necessary items of information, such as the heights of buildings in Dealey Plaza, the distance to objects not shown on the maps, the location of the DPD motorcade during the BBN reconstruction experiment and the air temperature in Dealey Plaza at the time of the assassination and during the reconstruction experiment.



### *1.3 Preliminary review of the characteristics and sources of the recorded sounds*

During 1963, communications that were transmitted on channel 1 of the DPD radio dispatching system were recorded continuously on a Dictabelt recorder. On November 22, 1963, a microphone on a mobile transmitter that was set to channel 1 apparently became stuck in the "on" position at about 12:28 p.m. and for about 5 minutes continuously transmitted sounds that it picked up. When we first listened to this interval on the DPD recording, we found that it contained a nearly continuous noise, with occasional speech, whistles, and clicks. Also recorded on the Dictabelt in this interval were the sounds that BBN identified as probable gunshots. To the ear, these sounds resembled static much more than they did a gunshot. However, as Dr. Barger testified in September, and as we independently verified, the equipment that was used in the DPD radio dispatching system was not designed to handle sounds as intense as a gunshot, and it was therefore likely to have recorded such sounds with very poor fidelity. Consequently, we recognized that these static-like sounds could be distorted gunshot sounds. On the other hand, such static-like sounds, theoretically could have been generated by a number of other sources, some acoustic, some related to electrical or mechanical disturbances in the DPD radio transmission, reception or recording equipment. Some test more discerning than the human ear was required to determine the probable cause of the sound impulses.

### *1.4 Basic principles and methods of analysis*

To answer the basic question, "Was the third group of recorded sounds generated by a gunshot from the grassy knoll?" with a high level of certainty, these sounds needed to be examined for some characteristic that they would have had if they had been generated by such a gunshot, and would not be likely to have had if they had not been. Of the several characteristics that can be used, the most effective and most reliable one is the sequence of delay times of the muzzle-blast echoes.

The firing of a gun generates a very loud, very brief explosive blast at the muzzle of the gun. This sound, which typically lasts about five one-thousandths of a second (0.005 seconds, or 5 milliseconds), spreads out in all directions from the gun. If the muzzle blast strikes a wall of a structure, it will be reflected from the surface and will move away from it in a new direction. If the muzzle blast strikes the corner of a structure, it will be diffracted, that is, it will spread out from the corner in many directions. These reflected and diffracted sounds are the echoes of the muzzle blast. Like the muzzle blast, which they closely resemble, the individual echoes are very short in duration. The strengths of the echoes tend to diminish with time, the earliest ones being very loud and the later ones growing progressively weaker as they arrive from increasingly distant locations.

The time taken for the muzzle blast to be heard at some location depends solely on how fast the sound travels and how far the listener is from the gun. For example, at 65°F the speed of sound is 1123 ft/sec. A listener 112.3 feet away from a gun would hear its muzzle blast 0.1 second after the gun was fired. The time taken for the muzzle blast echoes to be heard also depends on the speed of sound and on the total distance each echo must travel, which is the total of the distance from

the gun to the echo-producing object and then to the listener. Since the distance traveled by the muzzle blast to a listener must be less than the distance traveled by one of its echoes, the bang of the muzzle blast is always heard first. Then the echoes that are produced by the muzzle blast bouncing off the corners and surfaces of structures are heard.

If we now assume that the sound source (the gun) and the listener are located in a typical urban environment, with a number of randomly spaced echo-producing structures, it is possible to see that the pattern of sounds a listener will hear will be complex and unique for any given pair of gun and listener locations. For example, assuming a fixed location of a listener, the echoes that he hears and the times at which he hears them will be related uniquely to the location of the gun, since for each different location of the gun, even though the distances from the listener to the various echo-producing objects are the same, the distances from these objects to each gun location are different. Consequently, the times at which the echoes are heard will be different for each location of the gun. Similarly, assuming a fixed location of the gun, any change in the location of the listener will change the distances between him and the echo-producing structures, and thus the timing of the pattern of sounds he hears. If the listener is in motion as the muzzle blast and the various echo sounds reach him, the times at which he hears the muzzle blast and its echoes will be related uniquely to his location when he hears each sound.

A listener cannot tell, from the sounds of a gunshot, when the gun was fired. He can determine only the times that elapse between the muzzle blast and each of its echoes. These elapsed times are called the echo-delay times. Because the echo travel times are uniquely related to the locations of the gun and the listener, the echo-delay times are unique to any given pair of those locations. Hence, if we know the temperature (and thus, the speed of sound) and the location of the echo-producing structures, echo-delay times can be used to characterize the sounds of a gunshot for any pair of shooter and listener locations.

The "listener" that we have discussed, of course, could be either a human ear or a microphone. If a microphone receives the sounds and they are subsequently recorded, the recording becomes a picture of the event, not unlike a "fingerprint," that permanently characterizes the original gun and microphone locations.

Echo-delay times in such recordings can be measured easily and precisely by producing a graph of their waveforms on an oscillogram, or oscillograph. Such a graph is shown in figure 1. The narrow peaks represent individual sounds of brief duration (that is, impulse-sounds). The heights of the peaks correspond to the loudness of the impulse-sounds; the spacing between peaks corresponds to the time that elapses between them. The largest of the impulse peaks is the muzzle blast. The peaks that follow it are its individual echoes. The distance between the peak that is identified as the muzzle blast and each peak that repre-

sents an echo is a measure of the delay time of the echo. To convert this distance to a time measurement, it is multiplied by the time-scale of the graph. For example, the muzzle blast impulse in figure 1 and the sixth peak identified as an echo are 47 millimeters apart. Since the time-scale is 1 millisecond per millimeter (1 msec/mm), the measured echo-delay time is 47 milliseconds.

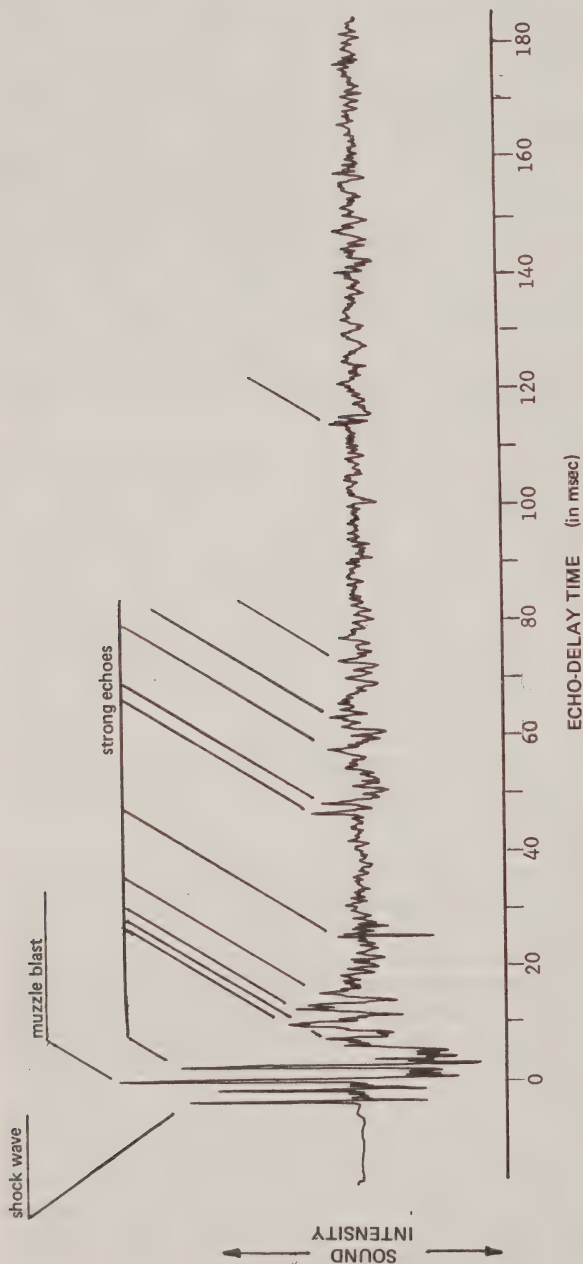


FIGURE 1 WAVEFORMS OF THE SOUNDS OF A GUNSHOT



It is easy to see how such a graph may be used for identification purposes. It provides a picture of the complex, random spacings of the echo-delay times. When the temperature of the air and the locations of the echo-producing objects are known, the graph is uniquely related to a particular pair of gun and microphone locations. This complex picture can be compared to other such graphs. If the random pattern of echo-delay times (the spacings between peaks) matches in any two such graphs, it may be concluded that the sounds and listener locations that produced both graphs were the same.

Of course, it may be that no second graph can be found that matches the first. Using the fingerprint identification process as an analogy, if a latent fingerprint taken from a knife found protruding from a murder victim's body is given to the FBI for identification, it may be that no matching "known" print is on file at FBI headquarters and that the murderer cannot be immediately identified. Furthermore, the police may proceed to take fingerprint samples from all of the suspects in the case and find that none match the one found on the murder weapon. In the end, the latent fingerprint may not be identified.

Applying the analogy to the graphs of sounds, our problem was to see if any of a number of assumed pairs of shooter and microphone locations would produce a pattern of sounds whose graph would match the graph of the sounds in question on the DPD tape. Before beginning the search, we knew that, just as in fingerprint identification cases, in the end we might find no match. If that occurred, of course, either of two conclusions would be required: (1) The real shooter and microphone locations could not be identified, or (2) the sounds on the tape were not produced by a gunshot in Dealey Plaza. On the other hand, if we found a shooter and microphone location that in combination would cause the same unique, random pattern of echo-delay times that were contained on the DPD tape recording, those sounds could be identified as probably being caused by such a gunshot.

For the sounds on the DPD recording, we knew what two of the four conditions that determine echo-delay time were at the time of the assassination. We knew what the speed of sound was and we knew where the major echo-producing objects were (and still are). We did not know exactly where to locate the gun, nor did we know through which sequence of locations on Elm Street to move the microphone. Therefore, we had to determine numerous hypothetical sequences of echo-delay times for gunshots that may have been fired from a variety of locations on the grassy knoll and picked up by microphones that moved through a variety of locations on Elm Street. This was accomplished in the only practical way possible—by predicting (i.e., mathematically calculating) the echo-delay time sequences that would be obtained for the various locations of a gun and a microphone.

After numerous comparisons between the echo-delay times for the sounds on the DPD recording and various predicted patterns for assumed motorcycle and shooter locations that did not match, a combination of motorcycle and shooter locations was found which mathematically produced a predicted pattern that showed strong similarities to the pattern of impulses on the DPD tape. However, to determine with a high level of certainty if these two sequences of echo-delay times, which were derived from different data, represented the same source, it was not enough to show that the sequences looked alike.

They had to be shown to be alike in an objective sense, that is, by use of a method of comparison that disregarded potentially misleading appearances. Such a method was provided by a computation of the binary correlation coefficient of the two sequences. The binary correlation coefficient of two sequences is a number that is exactly 1.0 if the sequences are identical and that rapidly approaches zero as they grow more dissimilar. As used in this analysis, the binary correlation coefficient takes into account the number of echo-delay times in each of the sequences and the number of echoes that coincide. Echoes in the two sequences are said to coincide if their delay times differ by a small amount. The smaller this amount, or "coincidence window," can be made while maintaining a high binary correlation coefficient, the greater will be the probability that the DPD sequence represents a gunshot from the grassy knoll.

### 1.5 *Results of the analysis*

Two different comparisons were made between the sequence of echo-delay times on the DPD tape and the most similar sequence of predicted echo-delay times. One of the comparisons was between those recorded sounds that were significantly louder than the average background noise and those predicted echoes that would have been recorded with comparable loudness. In the other comparison, the delay times of all of the recorded sounds and of all of the predicted echoes, up to a total delay of 50 milliseconds from the muzzle blast, were compared. The computed binary correlation coefficient was found to be 0.79 for the first comparison and 0.75 for the second.

In both of the comparisons described above, the coincidence window was set at  $\pm 1$  millisecond. That is, a measured echo-delay time and a predicted one were said to coincide only if they were no more than 1 millisecond apart. For sequences that correlated at levels greater than 0.7 with a coincidence window of  $\pm 1$  millisecond, the statistical probability was 95 percent or more that the sequences represented the same source—a sound as loud as a gunshot from the grassy knoll. Put alternatively, the probability that the sounds on the DPD recording were generated by sources other than a sound as loud as a gunshot originating from the grassy knoll is 5 percent or less.

### 1.6 *Findings*

The results of our analysis of sounds on the DPD recording permit the following findings:

1. The recording very probably contains the sound of a gunshot that was fired from the grassy knoll. The probability of this event is computed to be at least 95 percent.
2. The microphone that picked up the sounds of the probable gunshot was on Elm Street and was moving at a speed of about 11 miles per hour in the same direction as the motorcade. At the time the probable gunshot was fired, the microphone was at a point about 97 feet south of the TSBD and about 27 feet east of the southwest corner of the building. (For both distances, the uncertainty is about  $\pm 1$  foot.)
3. The probable gunshot was fired from a point along the east-west line of the wooden stockade fence on the grassy knoll, about 8 feet ( $\pm 5$  feet) west of the corner of the fence.



### 1.7 *Outline of the Report*

The method and results of this analysis are described in detail in the sections of the report that follow. The sounds on the DPD recording are described in section 2. Following in section 3, is a discussion of the nature of the problems in this analysis and of the considerations that underlie the method of solution. Section 4 discusses the steps that were taken to implement the procedure for predicting echo-delay times and describes the method and results of a test of this procedure. Section 5 discusses the methods that were used to determine and to compare echo-delay times for the recorded and predicted sequences.

## 2.0 DESCRIPTION OF THE RECORDED SOUNDS

The DPD recording contains a wide range of sounds—speech, clicks, whistles, motor noises, sirens and even the sound of a carillon bell. Mostly the recording contains sounds generated during normal communications on channel 1 of the DPD radio dispatching system. The speech transmissions usually were preceded and followed by sharp clicks. These were keying transients, probably generated by the switch on the transmitter microphones when they were turned on or off. Occasionally, a transmission was attempted while another one was in progress. When this occurred, the interference between the two transmitters usually generated a brief whistle, known as a heterodyne tone, that immediately followed the keying click of the oncoming microphone. At a time that the BBN analysis estimates to have been about 12:28 p.m., a microphone on a mobile unit apparently became stuck in the “on” position and began to transmit a continuous noise that is believed to be the sound of a motorcycle engine. For the first 2 minutes of the stuck-microphone transmission, the sound level of this noise is fairly constant. Occasionally, clicks and whistles can be heard through the noise, indicating attempts by other transmitters to use the channel. At several points, voices can be heard, but, being obscured by the noise, they cannot be understood. At 133 seconds after the start of the stuck-microphone transmission, the level of the noise drops by about 6 decibels (that is, to about one-fourth of its previous level). At almost the same moment a voice can be heard, communicating a brief but unintelligible message. This is followed about 3 seconds later by a series of randomly spaced, loud clicks and pops that lasts for at least 10 seconds. Some of the clicks occur singly, some in groups. Only one of them is accompanied by a heterodyne whistle and by an audible but unintelligible voice.

## 3.0 THE NATURE OF THE PROBLEM AND THE METHOD OF SOLUTION

### 3.1 *Distortion of the relative intensities of the echoes*

The sounds on the DPD recording that are thought to be those of gunshots begin about 5 seconds after the decrease in the level of the continuous noise and last for about 8 seconds. To the ear, these sounds resemble static, not gunshots. However, the equipment that was used in the DPD radio dispatching system in 1963 would have distorted the sounds of gunfire. The effect would have been to compress the peak amplitude of the sounds of the muzzle blast and of its strongest echoes, making them only slightly louder than those of some of the weaker



echoes. Furthermore, if the microphone was on a DPD motorcycle in the motorcade, most of the many very weak echoes of the muzzle blast would have been obscured by the noise of the motorcycle engine (which is possibly the source of the continuous noise on the DPD recording). Consequently, the sounds of a gunshot would have been recorded as a sequence of very brief impulse-sounds (the muzzle blast and its loudest echoes), only a few of which would have been larger than the accompanying engine noise, and none of which would have sounded to the ear like gunshots after being distorted by the limiting circuitry of the DPD radio and recording equipment.

### *3.2 Waveforms of the sounds on the DPD recording*

The waveforms of sounds in the DPD recording are shown in figure 2. The waveforms in the bracketed region include the group of impulse-sounds that the BBN analysis identified as a probable gunshot from the grassy knoll. This segment of the recording begins 144.9 seconds after the start of the stuck-microphone transmission and lasts for 0.36 seconds. The noise thresholds shown in the figure indicate the average peak levels of noise (mostly motorcycle noise) that can be heard immediately before and after this segment.

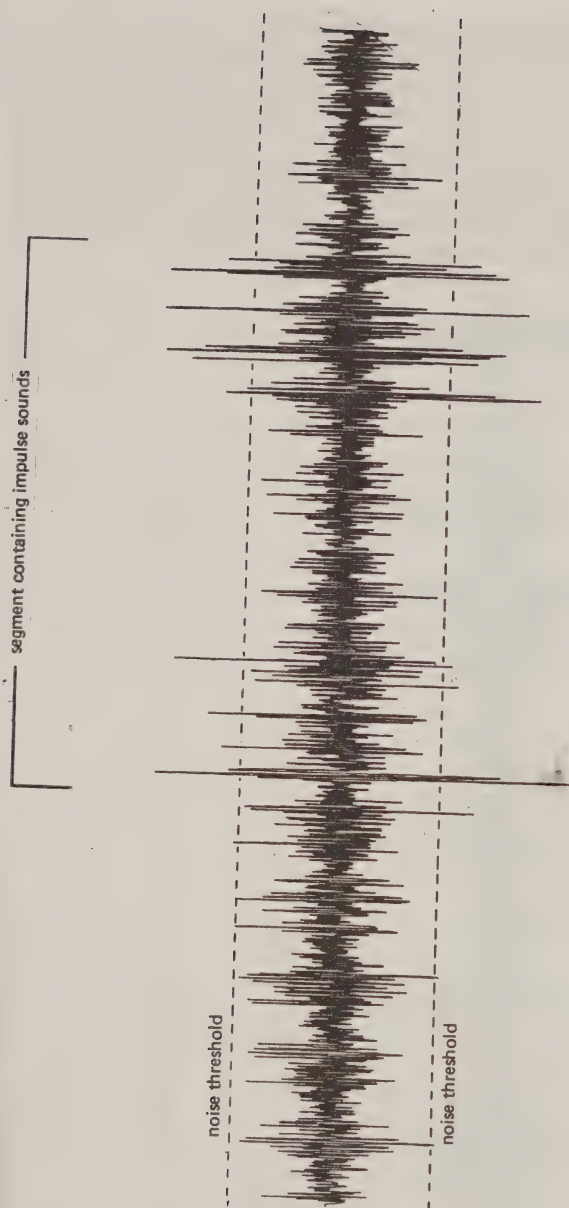


FIGURE 2 WAVEFORMS OF SOUNDS IN THE DPD RECORDING

Figure 3 shows the bracketed region in greater detail. The narrow peaks that exceed the thresholds, as well as many of those that do not, are the waveforms of the impulse-sounds that may be the sounds of a gunshot. Impulse peaks that are less than 1 millisecond apart are considered to be part of the same impulse. Altogether, 15 impulses exceed the thresholds. Five of them occur in the first 85 milliseconds following the one that is labeled as the muzzle blast. The remaining nine impulses occur in the 100-millisecond wide interval that begins about 280 milliseconds after the assumed muzzle blast.

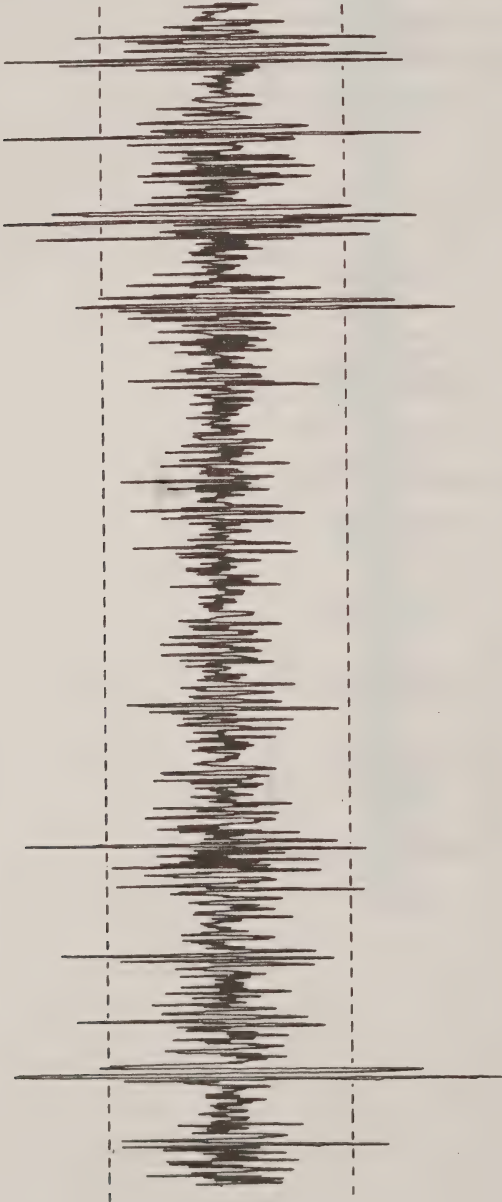


FIGURE 3 EXPANDED GRAPH OF WAVEFORMS OF SOUNDS IN THE DPD RECORDING



### 3.3 *Possible sources of the impulse sounds*

While it was possible that the louder impulse noises were the distorted sounds of a gunshot, it also is possible that they could have been generated in other ways. For example, they could have been the sounds of misfiring of the motorcycle engine. They could have been static-like impulse noises generated by the motorcycle's ignition system and picked up by the transmitter. The microphone that was stuck in the "on" position could itself have been the cause of impulses if from time-to-time it became unstuck and turned off briefly and then immediately turned on again. Impulse noises in the recording could also have resulted from scratches in the dictabelt on which the recording was made. Other components of the communication system could have been malfunctioning, producing electrical or mechanical disturbances that would have been recorded as clicks.

### 3.4 *Method of the analysis*

The essential questions to be answered were: "What is the source of the impulse-sounds in the DPD recording? Are they derived from the sounds of a gunshot that was fired from the grassy knoll and picked up by a microphone that was moving on Elm Street, or are they derived from one or more of the many other possible sources?" These questions could be answered with a high degree of certainty if the impulses could be shown to exhibit a characteristic that they would be expected to exhibit if they had been generated by a gunshot, and would not be likely to exhibit if they had not been. As explained in Section 1, such a characteristic is found in the unique pattern of time delays of echoes that buildings and other structures in Dealey Plaza would generate for a gunshot fired from the grassy knoll. If the impulse noises are the distorted sounds of a gunshot, their spacing should closely match that predicted for a shot fired from some location on the grassy knoll and "heard" by a microphone traveling along some path on Elm Street at 11 miles per hour. The closer the match between the actual and the predicted sequences, the greater the probability that the impulses are the sounds of a gunshot. If no shooter and microphone location can be found that can produce a sequence of echoes that closely matches the sequence of impulses on the tape recording, then it would have to be concluded that the impulses were not generated by sounds received by a microphone moving on Elm Street from a gun fired on the grassy knoll.

The procedure for determining the probable cause of the specified group of impulses on the DPD recording thus consisted of three steps. First was to calculate the pattern of echo delays that would be produced by a gunshot from a variety of locations on the grassy knoll and recorded by a microphone moving along a variety of paths on Elm Street. Then, select the sequence of predicted echoes that most closely matched the actual recorded sequence of impulses. Finally, compute the probability that impulse sounds generated by sources other than the predicted gunshot could occur by chance in a sequence that would match the selected echo sequence as closely as did the actual DPD recording.

## 4.0 IMPLEMENTATION OF THE ANALYSIS

4.1 *Preliminary considerations*

The implementation of the three-step procedure of the analysis required the consideration of a number of questions. Each of these affected either the results of the analysis or the method by which the required echo-delay time sequences were obtained.

4.1.1 *Source of the gunshot sounds*

If a gun was fired from the grassy knoll during the assassination, the would-be assassin reasonably could have used either a rifle or a pistol, since the target would have been less than 150 feet away. Since rifles typically fire bullets that travel faster than the speed of sound, the firing of a rifle generates two intermixed echo sequences composed of the echoes of the muzzle blast and the echoes of the continuously generated shock wave that is created by a bullet in supersonic flight. On the other hand, most pistol bullets do not fly at supersonic speeds. A pistol that fires a subsonic bullet generates only the set of echoes of the muzzle blast. Since we did not know what type of gun, if any, had actually been used on November 22, 1963, we sought only to compare the DPD tape with predicted sequences of echoes of muzzle blasts which would have been present regardless of the type of weapon fired.\*

4.1.2 *Placement of the gun on the grassy knoll*

The BBN analysis indicated that the gun was in the vicinity of the grassy knoll. During the acoustic reconstruction experiment that was conducted by BBN in Dealey Plaza on August 20, 1978, shots were fired from behind the wooden stockade fence on the grassy knoll. This location was consistent with available eyewitness and earwitness testimony. It was a reasonable one since it afforded good visibility of Elm Street while providing good cover for the shooter of a gun. At any other location on the grassy knoll either the visibility or the cover would have been substantially poorer. However, it is uncertain exactly where a shooter would have stood behind the fence, since equally good locations can be found up to 25 feet along the fence either north or west of its corner.

4.1.3 *Placement of the microphone on Elm Street*

The BBN analysis placed the stuck microphone on Elm Street in the vicinity of the fourth microphone in the third array of microphones that were set up in Dealey Plaza during the acoustic reconstruction experiment. As illustrated in figure 4, the microphones were located in the center of the street at points 18 feet apart along the route of the Presidential motorcade, from the intersection of Houston and Main Streets to the location of the Presidential limousine on Elm Street in Zapruder frame 312. The sounds of a gunshot from the grassy knoll received by each of these microphones were recorded during the experiment. Later, BBN determined the degree of match between the

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\*The DPD recording does contain a series of impulses that precede the large impulse ultimately determined to be the muzzle blast. The probability that these earlier impulses were the sounds of supersonic shock wave was discussed by Dr. Barger in his testimony before the committee on Dec. 29, 1978. See Vol. V of the hearings before the select committee, 94th Cong., 2d session (Washington, D.C.: U.S. Government Printing Office, 1979).

recordings from each of these microphones and the impulse noises on the DPD recording by calculating their binary correlation coefficients. A coincidence window of  $\pm 6$  milliseconds was used for these comparisons. Only one of the 36 comparisons yielded a correlation coefficient greater than 0.5 when compared with the segment of the DPD tape that is here at issue. That one—for the sounds received by microphone 4 in array 3—was at a level of 0.8, indicating a strong similarity between the echo sequence that was heard at that test loca-

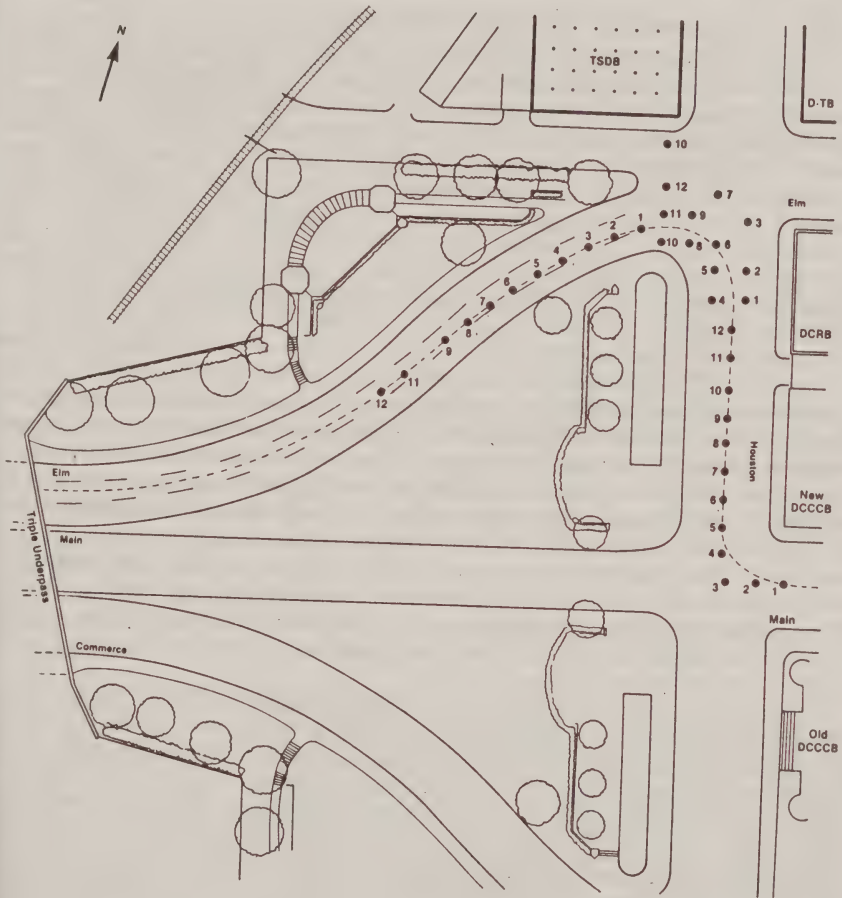


FIGURE 4 MICROPHONE LOCATIONS AT DEALEY PLAZA

tion in Dealey Plaza and the impulse sequence on the DPD recording. The low values of the binary correlation coefficients that were calculated for all of the other microphones indicate that there is no other microphone location either on Elm Street or on Houston Street at which a sequence of echoes caused by a shot from the grassy knoll could



be heard that was even moderately similar to the sequence of impulses on the DPD recording. It was therefore clear that for the purpose of analysis the microphone location in Dealey Plaza for which echo sequences had to be obtained was in the vicinity of microphone 4 of array 3. This region extends along Elm Street from halfway between microphones 3 and 4 to halfway between microphones 4 and 5, and from curb to curb (since the presumed motorcycle with the stuck microphone could be anywhere to the right or left of the center of the street).

#### 4.1.4 *Selection of the coincidence window*

To compare sequences of impulses and echoes by use of the binary correlation coefficient, it was necessary first to determine how many echoes coincided with impulses. Ideally, if the microphones that were used in the acoustic reconstruction experiment could have been spaced very closely along the route of the motorcade, say, 1 foot apart, and spread from curb to curb, impulses and echoes that were within 1 millisecond of one another could have been considered coincident. For practical reasons, the microphones were located in the middle of the street and spaced 18 feet apart. Also, only one of many possible shooter locations was used. To take into account these practicalities, the coincidence window for BBN's analysis was made  $\pm 6$  milliseconds. If a window of  $\pm 1$  millisecond had been used, there would have been few points of coincidence in any comparison, and all of the calculated binary correlation coefficients would have been small, since the chances would have been small that a microphone and a shooter would have been arbitrarily located in precisely the correct positions to receive a sequence of echoes that coincided with the sequence of impulses to within 1 millisecond. By increasing the coincidence window to  $\pm 6$  milliseconds, the number of coincident impulses and echoes was increased. However, so was the possibility that an impulse generated by a source other than a gunshot would appear to coincide with an echo. The major consequence of this was the value of 50 percent computed as the statistical probability that the impulses under examination were caused by the sounds of a gunshot.

To increase the certainty in our findings above a 50-percent level, we had to be able to reduce the coincidence window to as low a value as possible, preferably to  $\pm 1$  millisecond or less. Theoretically, this could be accomplished by placing microphones 1 foot apart in the region of interest and conducting additional test firings in Dealey Plaza from various locations on the grassy knoll. With respect to the microphone location problem alone, the relevant area on the street would be 720 square feet. Therefore, if, as in the BBN acoustic reconstruction experiment, microphones were placed in arrays of 12 each, a total of 60 arrays would be required for each position of a gun fired on the grassy knoll. Clearly, this approach was impractical.

#### 4.1.5 *Prediction of echo sequences*

The only practical way to obtain the needed echo sequence was to predict them analytically. Using fundamental principles of acoustics, it was possible to compute the time it would take for the sound of a muzzle blast to travel from a gun at any assumed point on the grassy knoll to a microphone at any assumed point on Elm Street. Knowing where the echo-producing objects were in Dealey Plaza, it was also

possible to compute the time it would take for echoes of the muzzle blast to travel from the gun to the microphone. Subtracting the muzzle-blast travel time from the echo travel times yielded the required sequence of echo-delay times.

The principles of acoustics that underlie this approach are described in detail in BBN Report. No. 3497 that was submitted to the committee in January 1979.\* The essential principles can be summarized as follows:

1. Most sounds spread out in all directions from the source of the sound.
2. If the medium (in this case, air) through which sound travels is uniform, sound will travel in straight lines from the source and at the same constant velocity in all directions of travel.
3. The time taken for sound to travel from one point to another can be computed by dividing the distance between the points by the speed of sound. For example, at a speed of 1,100 feet per second, it will take 0.5 second for sound to travel a distance of 550 feet. Conversely, the distance traveled by a sound can be computed by multiplying the travel time by the speed of sound.
4. Sound traveling through air will reflect from the surfaces and diffract from the corners of structures such as buildings, walls and columns.

#### *4.2 Information needed to predict echo-delay sequences*

Before the echo travel times could be calculated, it was necessary to determine three things: (1) Which objects in Dealey Plaza would produce echoes in the region of interest on Elm Street for a gun fired from the vicinity of the grassy knoll; (2) how far these objects were from the locations of the gun and of the microphone; and (3) what was the speed of sound under the conditions for which the echo travel times were to be predicted. When the required information had been obtained, it was used first to determine the accuracy of the echo procedure. Then it was used to predict echoes for comparison with the impulses in the DPD recording.

##### *4.2.1 Identification of echo-producing objects*

The objects in Dealey Plaza that would generate relevant echoes were identified with the aid of a topographical survey map of the plaza that was drawn to a scale of 1 inch equal to 10 feet. Most of these objects were corners of buildings or of walls that, as illustrated in figure 5, produced muzzle blast echoes in the selected region on Elm Street by diffracting the incident sound of a muzzle blast that was generated in the vicinity of the grassy knoll. Two of the objects, the wall of the DCRB and the curved wall at the reflecting pool, produced echoes by reflecting such a sound. In all, we were able to identify 22 objects that would generate echoes of sufficient strength that they would have been recorded on the Dictabelt recording. (See table 1.)

##### *4.2.2 Measurement of distances in Dealey Plaza*

The distances of the echo-producing objects from positions of a gun and a microphone were determined by direct measurement on the

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\*This report follows the present report.

survey map. By comparing the known widths of buildings in Dealey Plaza with measurements made on the map, we found the distances measured on the map to be accurate to about 0.5 foot. We measured distances on the map in millimeters, to the nearest half-millimeter. This simplified the making of measurements by providing a decimal

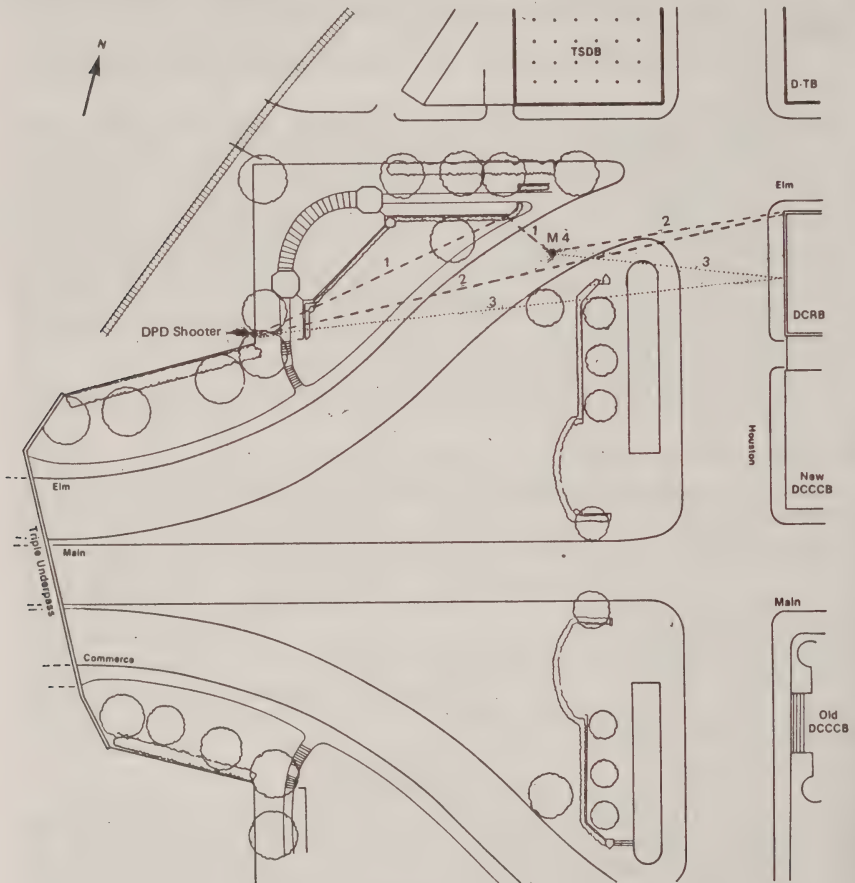


FIGURE 5 PATHS OF THREE MUZZLE BLAST ECHOES

scale. To simplify the calculation of the travel time of the echoes, we converted the speed of sound to an equivalent value for map distances that were measured in millimeters. For example, a speed of sound of 1,123 feet per second was converted to 2,852 millimeters per second for map measurements made in millimeters.



### 4.2.3 *The speed of sound*

The speed of sound in air is primarily a function of the temperature of the air. At a temperature of 65° Fahrenheit, it is 1,123 feet per second, and at 90° Fahrenheit it is 1,150 feet per second. To a first order approximation, in this temperature range the speed of sound increases at a rate of 1 foot per second per degree Fahrenheit. By comparison, humidity has a negligible effect on the speed of sound in air. Similarly, small variations in the temperature at different locations in Dealey Plaza would have a negligible effect on the average speed of sound over the path lengths of the echoes.

According to records of the weather bureau in Dallas, as obtained by the committee staff,\* the temperature in Dallas at 12:30 p.m. on November 22, 1963 was 65° Fahrenheit. This was substantially confirmed by a photograph that was taken in Dealey Plaza at about that time. In it, a sign on top of the TSBD can be seen on which the time is indicated as 12:40 and the temperature in Dealey Plaza as 68° Fahrenheit. Even if the temperature that was supplied by the weather bureau varied from the temperature in Dealey Plaza by 3° Fahrenheit, the resulting error of 3 feet per second is less than 0.27 percent of the speed of sound at 65° Fahrenheit. For most of the echoes, the resulting error in the computed echo-delay time would be less than 0.25 millisecond. Even for the echoes that travel the longest echo paths, the error would be less than 1 millisecond. In either case, the error is within the accuracy required for the echo prediction procedure. As is explained later in this report, temperature differences up to  $\pm 10^\circ$  Fahrenheit would have had negligible effect on the final results and would not substantially have changed the final conclusion nor the degree of confidence (the final statistical probability) that can be appropriately assigned to it.

Wind also will affect the speed of sound, increasing or decreasing it by an amount that depends on the speed of the wind and on the angle between the direction of the wind and the direction the sound travels. However, the delay time of an echo, which is determined by subtracting the muzzle blast travel time from the echo travel time, will be affected by wind only to the extent that the wind affects the echo and muzzle blast travel times differently. This in turn depends on the difference between the direction of the echo path and the direction of the direct muzzle blast path. For a gunshot fired from the grassy knoll and heard on Elm Street, the travel of most echoes is in approximately the same direction as the directly received muzzle blast. Consequently, the effect of wind on the delay times of these echoes is comparatively small, becoming significant only for windspeeds greater than 40 miles per hour. The weather bureau recorded winds in Dallas on November 22, 1963, as ranging only between 13 knots and 17 knots, which is roughly equal to 15 to 20 miles per hour.\*\*

### 4.3 *Accuracy of the echo prediction procedure*

Before proceeding to predict sequences of echoes for comparison with the sequence of impulses on the DPD recording, the accuracy of

\* See addendum A to the acoustics reports.

\*\*The actual recordings made at Dallas Love Field were 13 knots at 11:55 a.m., 13 knots at 12:30 p.m., and 17 knots at 1:00 p.m. See addendum B to the acoustics report.

the echo prediction procedure was tested. Given the estimated accuracy of the map, we expected to be able to predict echo-delay times to within  $\pm 1$  millisecond for specified locations of a gun and a microphone. However, it was essential to verify that this accuracy would be achieved in practice and that the identified echo-producing objects would generate significant echoes in the region of interest on Elm Street.

To test the procedure, we predicted the delay times of the echoes that would be received by a microphone at the location of microphone 4 of array 3, as shown in figure 5, for a shot fired from the grassy knoll by the DPD shooter during the acoustic reconstruction experiment. We then compared the predicted echo-delay times to echo-delay times actually recorded on the BBN tape recording of the shot that was fired by the DPD shooter. At the time that the test shot was fired, the temperature in Dealey Plaza was approximately  $90^{\circ}$  Fahrenheit. Accordingly, the value used for the speed of sound was 1,150 feet per second. As discussed in section 4.1.5, the echo-delay time is computed by subtracting the muzzle blast travel time (185.2 msec.) from the echo travel time. The muzzle blast travel time is obtained by dividing the distance between the gun and the microphone in Dealey Plaza (213 feet) by the speed of sound.

For echoes produced at the corners of structures, the measurement procedure was simple and direct. For example, the path of echo 2 in figure 5 consisted of two segments. As measured on the map, the segment from the shooter to the diffraction point was 499 millimeters and from that point to the microphone was 92 millimeters. The total path length, 591 millimeters, when divided by the sound-speed constant (2921 mm/sec) yielded an echo travel time of 0.2024 second (202.4 msec). Subtracting the muzzle blast travel time from the echo travel time yielded an echo-delay time of 17.2 milliseconds.

For an echo produced by a specular reflection, it was necessary first to locate the point at which the reflection would occur. Such reflections occur at that point on an echo-producing surface at which the total length of the echo path to that surface is a minimum. At that point, the reflecting surface will be tangent to an ellipse for which the locations of the gun and the microphone are the locii and the total length of the echo path is equal to the sum of the radii. The required ellipse was easily generated by the following procedure. First, a non-extensible string was cut to a length greater than the probable length of the echo path on the topographical map. One end of the string was tied to a pin at the location of the gun and a portion of the string near its other end was wrapped tightly around a pin at the location of the microphone. The string was then pulled toward the reflecting surface by the point of a pencil. With the string drawn taut, the pencil was moved so that its point drew an arc on the map in the region of the line that represented the reflecting surface. The length of the string was then adjusted until the arc was just tangent to the line. The point at which the arc touched the line was the desired point of reflection. The path from the gun to the point of reflection and then to the microphone (the echo path) was then measured. The total distance of the echo path divided by the speed of sound was the echo travel time. Subtracting from it the muzzle blast travel time yielded the echo-delay time.

TABLE 1.—*List of structures in Dealey Plaza that would have produced echoes of sufficient strength to have been recorded on the DPD tape*

Object No.:	Identification
1	South shelter: South door, east post.
2	South shelter: East door, south post.
3	South shelter: East door, north post.
4	North shelter: South door, west post.
5	North shelter: South door, east post.
6	North shelter: East door, south post.
7	North shelter: East door, north post.
8	Wall "A." <sup>1</sup>
9	Wall "A": Corner 1.
10	Wall "A": Corner 2.
11	Column "A" <sup>2</sup> : Southwest corner.
12	Wall "B" <sup>3</sup> : Corner 1.
13	Wall "B": Corner 2.
14	Column "B" <sup>4</sup> : West corner.
15	Wall at the north end of the reflecting pool.
16	DCRB: Southwest corner.
17	DCRB: Northwest corner.
18	DCRB: West wall (front of building).
19	DCRB: Roof edge on west wall.
20	DCRB: Southwest corner.
21	New DCCCB: Northwest corner.
22	DCRB—New DCCCB: Alley wall between buildings.

<sup>1</sup> Wall "A" is a concrete wall on the north side of Elm St. that runs in an east-west direction. Corners 1 and 2 are at the east end of the wall. The direction of the wall changes from east to northeast at corner 1, and from northeast to north at corner 2.

<sup>2</sup> Column "A" is a concrete column on the north side of Elm St. near the intersection with Houston St.

<sup>3</sup> Wall "B" is a concrete wall on the south side of Elm St. near the reflecting pool. It runs in a generally north-south direction. Corners 1 and 2 are at the northern end of the wall. The direction of the wall changes from north to northeast at corner 1 and from northeast to east at corner 2.

<sup>4</sup> Column "B" is a concrete column on the south side of Elm St., at the northern end of Wall "B."

TABLE 2.—*List of echo paths used in the predictions of echo-delay times*

Path No.:	Echo producing objects (Identification numbers)
1	1
2	2
3	9
4	2, 8
5	10
6	5
7	4
8	6
9	7
10	12
11	13
12	14
13	3, 13
14	3, 14
15	3, 15
16	16
17	8, 13
18	19
19	18
20	21
21	22
22	4, 19
23	6, 19
24	20
25	17
26	23



TABLE 3.—MEASURED AND PREDICTED DELAY TIMES OF ECHOES FOR A GUNSHOT FIRED ON AUG. 20, 1978  
[In milliseconds]

Echo path	Echo travel time	Echo-delay time <sup>1</sup>		Deviation
		Predicted	Measured	
1	192.3	7.0	7.3	0.3
2	196.0	10.8	11.2	.4
3	198.6	13.4	13.1	.3
4	201.7	16.5	16.9	.4
5	202.4	17.2	16.9	.3
6	213.0	27.8	28.3	.5
7	213.0	27.8	29.8	2.0
8	215.4	30.1	29.8	.3
9	218.1	32.9	32.9	0
10	228.4	43.2	42.3	1.1
11	229.4	44.7	45.6	.9
12	232.5	52.3	52.9	.6
13	243.4	58.2	60.0	1.8
14	252.7	67.5	68.3	.8
15	259.9	74.7	76.9	2.5
16	267.1	81.9	82.5	.6
17	267.4	82.2	83.1	.9
18	451.6	266.7	266.6	.1
19	455.0	269.8	269.2	.6
20	458.1	272.9	272.2	.7
21	469.2	284.0	282.3	1.7
22	482.8	297.6	297.7	.1
23	482.8	297.6	297.7	.1
24	487.2	302.0	303.2	1.2
25	497.8	312.6	313.0	.4
26	541.3	336.1	354.0	2.1

<sup>1</sup> For the calculated locations of the gun and the microphone, the muzzle blast travel time is computed to be 185.2 ms.

Using the methods described above, 26 echo paths were defined for 22 echo-producing objects. For some of these paths, the muzzle blast sound bounced off more than one echo-producing object. The echo-producing objects and echo paths are listed in tables 1 and 2. The travel times and the delay times for the predicted echoes are listed in table 3. Also listed are the echo-delay times determined by analysis of the time waveforms of the sounds received at microphone 4 of array 3 for the shot fired by the DPD shooter from the grassy knoll. These waveforms, which are shown in figure 6, were obtained by playing back the recording of the sounds that were picked up by the microphone, modifying the reproduced signal so as to approximate the effect that a microphone of the type used by the DPD in 1963 would have had on the signal, and then graphing the resulting signal. A 60-Hz tone that was recorded in one segment of the recording made during the testing in August 1978 made it possible to calibrate the time scale of the graph at 1 millisecond per millimeter. The first waveform appearing in the graph, the large peak at the left-hand side, corresponds to the supersonic shockwave of the rifle bullet. The second large peak is the waveform of the muzzle blast. Following it, with generally diminishing heights, are the waveforms of the echoes of the muzzle blast. The delay time of each echo was determined by direct measurement of the distance from the leading edge of the muzzle blast waveform to that of the echo. The numbered peaks shown in this figure correspond to the predicted echoes identified in table 3.

The deviations between the predicted and measured echo-delay times listed in table 3 were in part due to small errors in the locations of the

\*At the time of the presentation of our findings on Dec. 29, 1978, 22 echo paths had been defined. After that date, four additional paths were defined.

gun and the microphone. The microphone location was determined from a map of Dealey Plaza that showed where microphones were to be placed during the reconstruction experiment. However, the scale of the map, 1 inch equal to 40 feet, limited the measurement accuracy to about plus or minus 2 feet. Therefore, the actual location of the microphone may have deviated from the indicated one by a foot or two. Similarly, there were no measurements taken of the exact location



FIGURE 6 FILTERED WAVEFORMS OF GUNSHOT SOUNDS RECEIVED AT MICROPHONE 4 OF ARRAY 3

where the DPD shooter stood as he fired each shot from the grassy knoll. Consequently, it was likely that the gun and the microphone locations that were used for the echo-delay time predictions were slightly in error and that if these positions were adjusted correctly, the resulting predictions would be closer to the measured echo-delay time.

An analysis of the data listed in table 3 shows that the assumed locations were sufficiently accurate for the purpose of this test. The average absolute difference between the predicted and measured echo-delay times was 0.8 millisecond. The standard deviation of predicted

delay times about this average was 0.7 millisecond. These results are well within the accuracy required of the echo prediction procedure.

## 5.0 COMPARISON OF THE SEQUENCE OF IMPULSES ON THE DPD RECORDING WITH SEQUENCES OF PREDICTED ECHOES

### 5.1 *Prediction of echoes for November 22, 1963*

Using the techniques described in section 4, we predicted echoes and echo-delay times for gunshot sounds that would have been heard in Dealey Plaza at 12:30 p.m. on November 22, 1963. The predictions were made given the following conditions: (1) The air temperature was 65° F (with a possible error of 3° F); (2) the gun was somewhere along the wooden stockade fence on the grassy knoll; (3) the microphone was somewhere in the region of interest on Elm Street (see section 4.1.3) and moving with the motorcade at a speed of about 11 miles per hour; and (4) the echo-producing objects were the same as those identified in table 1.

The procedure that was used to predict echoes required a few more steps than the method described in section 4. Since the conditions required the microphone to be moving on Elm Street at a speed of 11 miles per hour, the location of the microphone on the map had to be moved in a similar manner. First, a location was specified on the map at which the microphone received the muzzle blast. Then, the microphone was moved along a path corresponding to the path it would have traveled on Elm Street during the time it received all of the predicted muzzle blast echoes. The location of the microphone at the time it would have received each particular echo was determined by calculating the distance the microphone would have moved from the initial position at a constant speed of 11 miles per hour during an interval equal to the echo traveltime. Small deviations about this estimated distance (for example,  $\pm 1$  millimeter) did not materially affect the predicted echo travel time. The predicted echo-delay times were then obtained by the procedure described in section 4.

### 5.2 *Correction of time delay measurements*

The delay times of the impulse sounds on the DPD recording were measured directly from a graph of the sequence of impulse waveforms, such as the one shown in figure 3. To simplify the measurement of time intervals, the graph was plotted with a time scale of 1 millisecond per millimeter (1 msec/mm). However, before the measurements could be used, they had to be multiplied by a time-correction factor to correct for an error in the speed of the DPD Dictabelt machine. As was shown in the BBN analysis, the DPD recorder was running slow at the time the recording was made. Consequently, when the recording is played back at the faster, correct speed, the recorded impulse sounds will be heard closer together than they actually were at the time the recording was made. This error could be corrected by multiplying the time intervals measured on the graph by a time-correction factor. The BBN analysis showed that between 12:22 p.m. and 12:37 p.m., the average speed of the recorder was 0.95 of correct speed. The actual speed at any time during this interval could have been from 0.94 to 0.96 of true speed. Accordingly, the time-correction factor could range from 1.04 to 1.06.

An adjustment in the measurement of impulse delay times would also be necessary if the temperature in Dealey Plaza at 12:30 p.m. on



November 22, 1963, was not 65° F, as was initially assumed. The computed delay time of each predicted echo would be in error by about 0.1 percent for each 1° F difference between the true temperature and the assumed value of 65° F. The effect on the predicted echoes would be to scale their spacing from what they should be. For example, if the true temperature was less than 65° F, then the predicted echoes would be closer together than they should be. Conversely, if the true temperature was more than 65° F, the computed echoes would be spaced more widely than they should be. Since it was not likely that the assumed temperature differed from the true temperature by more than 10° F, the factor for correcting temperature errors would range only from 0.99 to 1.01. Assuming that the differences in temperature and recorder speed occurred in such a way as to compound one another, the combined factor that would correct for both recorder speed and temperature at the same time could range from 1.03 to 1.07. Because we knew that the range of the correction was 1.03 to 1.07, theoretically we could use any value between 1.03 and 1.07 to adjust the measured time intervals between the impulses on the DPD recording.

Because any value between 1.03 and 1.07 was theoretically valid, it was permissible to choose the value between those limits that created the best match between the impulse and echo sequences. By fitting the DPD tape recorded impulse sequence to our predicted echo sequences, we found that a time-correction factor of 1.043 gave the best match, and we therefore used that factor.

TABLE 4.—MEASURED DELAY TIMES OF IMPULSES AND PREDICTED DELAY TIMES OF GUNSHOT ECHOES FOR  
NOV. 22, 1963  
[In milliseconds]

Echo path	Echo travel time	Echo delay time	Impulse delay time	Deviation
1	202.4	6.5	6.3	0.2
2	206.8	10.9	10.5	.4
3	211.0	15.1	14.7	.4
4	214.7	18.8	19.3	.5
5	217.0	21.1	20.1	1.0
6	224.3	28.4	27.4	1.0
7	225.2	29.3	30.3	1.0
8	227.1	31.2	31.6	.4
9	230.6	34.7	34.1	.6
10	244.1	48.2	48.7	.5
11	241.5	45.6	45.4	.2
12	250.3	54.4	54.2	.2
13	255.2	59.3	59.7	.4
14	266.0	70.1	69.4	.7
15	273.4	77.5	77.4	.1
16	281.8	85.9	85.3	.6
17	276.7	80.8	80.2	.6
18	473.9	278.0	278.6	.6
19	479.8	283.9	283.7	.2
20	479.8	283.9	283.7	.2
21	489.1	293.2	292.1	1.1
22	506.8	310.9	310.5	.4
23	507.9	312.0	312.4	.4
24	509.6	313.7	313.1	.6
25	524.0	328.1	327.5	.6
26	565.0	369.1	369.2	.1

<sup>1</sup> For the calculated locations of the gun and the microphone, the muzzle blast travel time is computed to be 195.9 ms.

### 3 Comparison of the impulse and echo sequences

The sequence of predicted echo-delay times that best matched the sequence of impulse-delay times, computed as described above, is listed in table 4. The numbered peaks shown in figure 7 correspond to the

predicted echoes identified in table 4. The average absolute difference between the impulse-delay times and the corresponding echo-delay times is 0.5 millisecond, and the standard deviation of impulse-delay times about this average is 0.3 millisecond.

The location of the gun and the path of the microphone for which these predicted echoes were obtained are shown in figure 8. The microphone is initially located 97 feet south of the TSBD and 27 feet east of the southwest corner of the TSBD. The path of the microphone, as it received the muzzle blast and its echoes, extends for about 6 feet

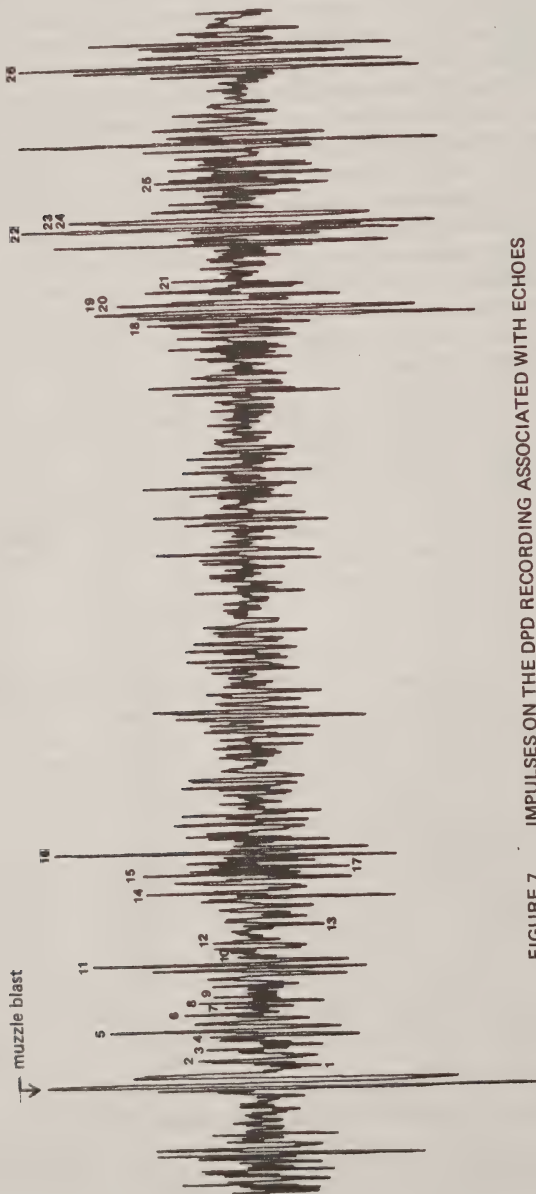


FIGURE 7 IMPULSES ON THE DPD RECORDING ASSOCIATED WITH ECHOES

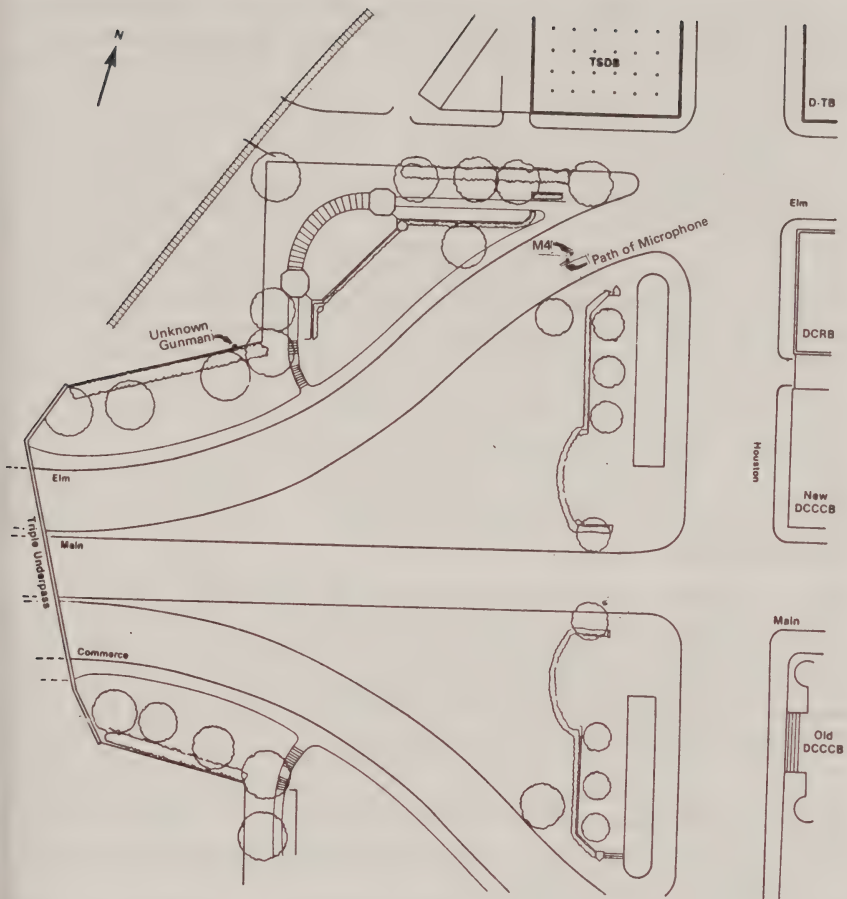


FIGURE 8 LOCATION OF THE GUN AND PATH OF THE MICROPHONE  
COMPUTED FOR NOVEMBER 22, 1963

along Elm Street. The uncertainty in the initial position is  $\pm 1$  foot, which corresponds to the accuracy of measurements made on the topographical survey map. The gun is located about 8 feet to the left of the corner of the wooden stockade fence on the grassy knoll. If the gun is moved along the fence from this location, the delay times of the muzzle blast echoes changes. However, for movements up to  $\pm 5$  feet, these changes can be reduced to less than 1 millisecond by making a small adjustment in the initial location of the microphone.

The data in table 4 suggest that the sequence of impulses on the DPD recording is very similar to the sequence of predicted echoes. A visual comparison indicates that almost all of the impulses and echoes coincide within a window of  $\pm 1$  millisecond. However, such an examination can be deceptive. It does not take into account the impulses that



do not coincide with echoes, or the echoes that are not matched by impulses of even minimal amplitude. For these reasons, a more appropriate method of comparison was to compute the binary correlation coefficient of the sequences.

#### 5.4 *Factors affecting the selection of impulses and echoes for correlation*

Ideally, a correlation of the impulses and the predicted echoes would have included all of the impulses evident in the waveforms of figure 7 and all of the predicted echoes. However, some of the impulses must have represented components of the background noise. To minimize the number of noise impulses that might be included in the correlation calculation, only those impulses that were greater than the average peak level of the background noise were counted. This required limiting the predicted echoes that were included in the correlation calculation to those that would have been recorded at a level above that of the background noise. To identify these echoes and impulses, it was necessary to consider, first, the relative strengths of predicted echoes near the microphone, and then the way in which the DPD radio dispatching system would have altered both the relative strengths of the echoes as recorded and the recorded level of the background noise.

##### 5.4.1 *Relative strengths of echoes near the microphone location*

The relative strengths of the predicted echoes at locations along the path traveled by the microphone would be similar to those of the actual echoes of a muzzle blast that were recorded during the acoustical reconstruction experiment at the nearby location of microphone 4 in array 3 (see fig. 5). The strengths of echoes received at these nearby locations would not differ by more than a few decibels. Therefore, the relative strengths of the predicted echoes in the vicinity of the moving microphone could be taken to be the same as those received by microphone 4.

##### 5.4.2 *Effects of the DPD radio dispatching system on the relative strengths of recorded echoes*

The DPD radio dispatching system contained a circuit that would have greatly affected the relative strengths of the recorded echoes of a muzzle blast. This circuit, the automatic gain control (AGC), limited the range of variations in the levels of signals by reducing the levels of received signals when they were too strong and increasing their levels when they were too weak. It responded very rapidly to a sudden increase in the level of a signal, but comparatively slowly to a sudden reduction in a signal level. Consequently, the response of the AGC to the sound of a muzzle blast would greatly reduce the recorded levels of echoes and background noise received shortly afterward. Progressively during the next 100 milliseconds, the AGC would allow the recorded levels of received signals to increase until full amplification was finally restored. The effect on the predicted echoes would be to make the recorded levels of late-arriving echoes very nearly the same as those of the early ones. Concurrently, the recorded background noise would gradually rise to its level before the muzzle blast was received.

A different but also significant effect on the relative strengths of the recorded echoes would have been caused by the motorcycle windshield. On the DPD motorcycles, the microphone was usually mounted on a

bar directly behind the windshield. Sounds arriving from the front of the motorcycle would have diffracted around the windshield and in doing so would have lost strength. As determined by experiment, the windshield of a 1960's Harley Davidson motorcycle attenuated gunshot sounds received from in front of the motorcycle by from 3 decibels to 6 decibels. The amount of attenuation depended on how close the microphone was to the windshield. Obviously, sounds received from the sides and rear of the motorcycle would not be affected by the windshield.

### 5.5 *Correlations of impulse and echo sequences*

The selection of impulses for the calculation of the binary correlation coefficient depends directly on the noise level to which the heights of the impulses are compared. This level can be set, as in figure 2, at the average peak level of the recorded noise immediately adjacent to the recorded impulses. This approach, however, presumes that the noise level is the same during the impulse segment as it is in the adjacent segments of the recording. As was discussed above, the level of the noise recorded during the first 50 milliseconds following a muzzle blast will be greatly reduced. Consequently, an alternative would be correspondingly to lower the level to which the impulses are compared during this 50-millisecond period.

Both approaches to setting the amplitude comparison level were used, each in a separate calculation of the binary correlation coefficient. For the first calculation, the amplitude comparison level was set as in figure 2. Taking all of the factors discussed in section 5.4 into account, we found that 13 gunshot sounds (the muzzle blast and 12 of the predicted echoes) would have been loud enough to have been recorded at a level above the background noise. Eleven of these sounds coincided, within a  $\pm 1$ -millisecond window, with impulses that exceeded the amplitude comparison level. Including the leading impulse, which was identified as the muzzle blast, a total of 15 impulses exceeded this level. The binary correlation coefficient was calculated as the number of gunshot sounds and impulses that coincided (11) divided by the square root of the product of the number of selected impulses (15) and the number of selected gunshot sounds (13). For these data, the binary correlation coefficient was calculated to be 0.79.

For the second calculation of the binary correlation coefficient, the delay time range over which impulses and echoes were compared was limited to the first 50 milliseconds following the muzzle blast, since this was the range in which the AGC would have had greatest effect. (It is also the range in which most of the echoes arriving from the front of the motorcycle occurred.) In this calculation, the amplitude comparison level was reduced to one-fourth of its value during the previous calculation, which placed it at a level just above that of very small peaks among the waveforms of the recorded impulses. Eighteen impulses exceeded this level. So would have the muzzle blast and all 11 echoes that were predicted to occur in the delay time range up to 50 milliseconds. Eleven of these sounds coincided, within  $\pm 1$  millisecond, with one or another of the selected impulses. These data—11 coincident impulses and echoes, 12 gunshot sounds, and 18 impulses—resulted in a computed binary correlation coefficient of 0.75.

### 5.6 *The probability that the recorded impulses are not gunshot sounds*

The high degree of correlation between the impulse and echo sequences does not preclude the possibility that the impulses were not the sounds of a gunshot. It is conceivable that a sequence of impulse sounds, derived from nongunshot sources, was generated with time spacings that, by chance, corresponded within one one-thousandth of a second to those of echoes of a gunshot fired from the grassy knoll. However, the probability of such a chance occurrence is about 5 percent.\* This calculation represents a highly conservative point of view, since it assumes that impulses can occur only in the two intervals in which echoes were observed to occur, these being the echo-delay range from 0 to 85 milliseconds and the range from 275 to 370 milliseconds. However, if the impulses in the DPD recording were not the echoes of a gunshot, they could also have occurred in the 190-millisecond timespan that separated these two intervals. Taking this timespan into account, the probability becomes considerably less than 5 percent that the match between the recorded impulses and the predicted echoes occurred by chance. Thus, the probability is 95 percent or more that the impulses and echoes have the same source—a gunshot, or a sound at least as sound as a gunshot, from the grassy knoll. Stated differently, the odds are less than 1 in 20 that the impulses and echoes were not caused by a gunshot from the grassy knoll, and at least 20 to 1 that they were.

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\*See the BBN report No. 3947.



**Report No. 3947**

# **Analysis of Recorded Sounds Relating to the Assassination of President John F. Kennedy**

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January 1979

Prepared for:  
Select Committee on Assassinations

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## FOREWORD

On May 12, 1978, the House Select Committee on Assassinations asked Bolt Beranek and Newman Inc. (BBN) to conduct a preliminary review of the following material:

- Tape recordings reportedly made of the sounds in Dealey Plaza around 12:30 pm on November 22, 1963
- Transcripts of the testimony of earwitnesses who were in the Plaza at that same time.

The purpose of this review was to determine which, if any, of this material constituted potential evidence with respect to the gunfire associated with the assassination of President John F. Kennedy.

The review established that (1) only two of the recordings constituted potential evidence and (2) a statistical analysis of the earwitness testimony could reveal whether the concept of one rifle is consistent with these individual accounts.

The two tapes found to be made of the events surrounding the assassination were records from Channels 1 and 2 of the Dallas Police Department's (DPD) radio dispatching system. The Channel 1 tape contains a continuous record of the sounds transmitted between 12:28 and 12:34 pm over a DPD motorcycle radio stationed in Dealey Plaza. The Channel 2 tape is an intermittent recording of additional radio traffic - in particular, communications between the Chief of the Dallas Police Department, who occupied the car immediately preceding the Presidential limousine in the motorcade, and the Channel 2 Dispatcher at DPD headquarters.

An initial analysis of a portion of the Channel 1 tape did not rule out the possibility that the recording contained the sounds of gunfire. The House Committee therefore authorized BBN to conduct studies both of the DPD tapes and of the earwitness testimony. This report describes the results of an analysis of the tapes. The study of earwitness testimony is reported under separate cover.\*

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\*Green, D.M., "Analysis of Earwitness Reports Relating to the Assassination of President John F. Kennedy," BBN Rep. 4034, January 1979.



## ACKNOWLEDGMENT

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## 1. INTRODUCTION AND SUMMARY

The House Select Committee on Assassinations authorized Bolt Beranek and Newman Inc. (BBN) to study two tape recordings made by the Dallas Police Department (DPD) on November 22, 1963 on Channels 1 and 2 of the DPD's radio dispatching system. Channel 1 is the channel ordinarily used to handle DPD radio traffic, and this channel is recorded continuously on a Dictabelt recorder. Channel 2, an auxiliary channel generally used to handle the additional radio traffic necessitated by special events, is recorded intermittently on a Gray Audograph recorder, as actuated by voice communications and time annotation. Frequent time annotations - usually at 1-minute intervals - are made by the radio dispatchers handling each of these channels.

On November 22, 1963, during the time of President Kennedy's assassination, the radio of a DPD motorcycle, which may have been in the motorcade, was stuck in the transmitting mode on Channel 1 for approximately 5 minutes. During this time, the Chief of the Dallas Police Department, whose car immediately preceded the President's limousine in the motorcade, transmitted several messages concerning the progress of the motorcade over Channel 2. Channel 2 had been designated for use by DPD officers in the motorcade on November 22, 1963. Therefore, if the Channel 1 recording were to contain sounds of gunfire associated with the assassination, then at least one of the motorcycle radios used in the motorcade must have been incorrectly switched to Channel 1. Voice transmissions on both tapes were monitored for the call numbers of the 18 motorcycle officers in the motorcade. Six of the officers were heard to transmit on Channel 2; three on Channel 1.\* The other nine did not make any transmissions, so it cannot be determined which channel their radios were set for.

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\*These three transmissions were made at about 2:10 pm, 4:39 pm, and 5:22 pm, all later times than the assassination.



### 1.1 Initial Analysis

The questions to be addressed in the analysis of these tapes were:

- Does the 5-minute segment recorded on Channel 1 contain the sound of gunfire?
- If so, how many shots were recorded and from what location (or locations) did the shots originate?

To begin with, if gunfire had been recorded on Channel 1, the analysis of that tape could be expected to reveal patterns of transient waveforms that would be generally characteristic of the shock wave produced by the bullet, of the loud and impulsive noise of the muzzle blast, and of echoes of each. It could further be expected that the major components of the shock wave would appear in the 1-kHz to 3.2-kHz frequency band.

The initial analysis of the Channel 1 tape therefore consisted of filtering and recording the entire 5-minute segment through each of two filters designed to reveal the presence of any transient impulsive waveform patterns that might be masked by the repetitive loud noise of the motorcycle. The first was a bandpass filter that filtered out all sounds not contained within the frequency range extending from 1 kHz to 3.2 kHz. This range was known to contain the principal frequency components of the shock wave produced by the bullet and to contain relatively few components of motorcycle noise. The second filter was an adaptive Widrow LMS filter, which studies the repetitive nature of noise, estimates what it will be a short time later, and subtracts these noise components out, leaving transient events not anticipated by the filter.

The recorded outputs from both filters for the full 5 minutes were compared, examined, and plotted on a scale where 5 in. equals 1/10 sec. These plots revealed five impulse patterns introduced by a source other than the motorcycle. Upon closer examination, all but one of these patterns were sufficiently similar to have had the same source, and the impulses contained in these patterns appeared to have shapes similar to the expected characteristics of a shock wave and of a muzzle blast. The remaining pattern was sufficiently different in amplitude and duration as to have been caused by a different source.

The hypothesis to be tested, then, was that these four impulse patterns were caused by gunfire. Initially, this hypothesis was subjected to five simple, but necessary, screening tests:

1. Time of occurrence
2. Uniqueness of patterns
3. Time span between patterns
4. Shape of impulses within the patterns
5. Amplitude of impulses.

Should the hypothesis then pass these tests, a sixth, more rigorous, test would be applied. This final test would require an acoustical reconstruction of the circumstances of the original gunfire in Dealey Plaza to reveal the relative times that muzzle blast and shock wave impulses, together with their echoes, would arrive at microphones located where the motorcycle radio might have been.

## 1.2 Screening Tests

The five screening tests were designed to determine whether the characteristics of the four impulse patterns corresponded both to other evidence and to the characteristics of actual gunfire.

1. *Did the impulse patterns occur at the same time the shots were actually fired? Yes.*

Stopwatch timing and examination of both tapes placed the time of the shot and the time of onset of the first pattern of waveforms within 35 sec of each other. The margin of acceptable time difference was 60 sec, since the two time clocks used by the two dispatchers were synchronized to within just 1 minute.

2. *Were these impulse patterns unique? Yes.*

Examination of the entire 5-minute segment did not reveal sufficiently similar impulse patterns elsewhere on the tape to discount gunfire as the source of these four patterns.

3. *Did the time span between the patterns correspond to other evidence of intervals between shots? Yes.*

The intervals between the onset times of the four impulse patterns on the DPD tape with the frames on the Zapruder film showing bullet impact were compared. According to the Zapruder film, the time span between the earliest and the latest gunfire-like events recorded on Channel 1 had to be no less than 5.6 sec. The span between onset times of the first and the fourth patterns was 8.3 sec.



4. *Did the shape of the impulse patterns resemble those generated by actual rifle fire? Yes.*

Tape recordings of test shots made with a Mannlicher-Carcano rifle were put through electrical circuits that mimicked those through which the 5-minute segment had been recorded. The shape of the impulse patterns on the Channel 1 tape approximates those produced by the test shots.

5. *Did the range of amplitude (loudness) of the impulse patterns resemble that of the echo patterns produced by the test shots? Yes.*

Processing the echo patterns of the test shots through a radio receiver like that used in the DPD recording system showed similar compression of the range of amplitude of recorded signals with respect to the range of the signals fed into the receiver.

The answers to these five questions neither proved nor disproved the possibility that the four impulse patterns on the Channel 1 tape had been caused by gunfire. A more rigorous analysis was required to determine with some confidence whether or not these patterns had been caused by gunfire.

### 1.3 Further Analysis

The gunfire and the potential motorcycle radio positions on November 22, 1963 were acoustically reconstructed on August 20, 1978 in Dealey Plaza. The sounds were subsequently processed into echo patterns, each one representing the unique "fingerprint" of gunfire sounds as heard at one location when a weapon is fired from one place to one target. The Channel 1 recording made at the time of the assassination had been similarly processed into sound impulse patterns. However, the

Channel 1 impulse patterns were like badly smudged "fingerprints," because of the extremely noisy environment in which the original recording had been made.

The echo patterns were compared to the impulse patterns to see if any of the clear "fingerprints" obtained during the reconstruction matched any of the smudged "fingerprints" on the Channel 1 recording. The matching process was a binary correlation detector - a simple but powerful signal-detection scheme that is conducted mathematically.

Several echo patterns from the acoustical reconstruction matched sufficiently well with the four impulse patterns that we were able to place the motorcycle behind the Presidential limousine, at distances varying from 120 ft to 160 ft.

The correlation detector indicated that four shots may have been fired, as follows:

1. time 0.0 sec - one shot from the Texas School Book Depository (TSBD) aimed between the limousine positions seen in frames 160 and 313 of the Zapruder film
2. time 1.6 sec - one shot from the TSBD aimed near the limousine position seen in frame 313
3. time 7.8 sec - one shot from behind the fence on the knoll aimed near the limousine position seen in frame 313
4. time 8.3 sec - one shot from the TSBD aimed between the limousine position seen in frame 313 and the triple underpass.

#### 1.4 Conclusions Based on Results of the Acoustical Reconstruction

The conclusions drawn from the results of the matches obtained by our analysis were presented at the public hearing before the committee on September 11, 1978. Essentially, we had concluded that the motorcycle had indeed been in the motorcade and that possibly four shots had been fired at President Kennedy. The reason that our findings with respect to the four shots were stated in terms of probabilities is as follows.

The correlation detector produced several false alarms that could be identified as such. These false alarms are spurious matches caused by uncertainty of the exact motorcycle position with respect to the known positions of microphones used in the reconstruction test. Therefore, some of the correlations that indicated the four shots must also be suspected as false alarms. This uncertainty introduced by the suspected false alarms can be expressed as a set of probabilities on the possible true outcomes. These probabilities were calculated from the judgment that each match has a 50% probability of being a false alarm and from the assumption that each match is an independent observation. Thus, the individual probabilities that the shots occurred at each of the four times are:

- Shot 1. 88% based on three matches
- Shot 2. 88% based on three matches
- Shot 3. 50% based on one match
- Shot 4. 75% based on two matches.

The probability that the four possible shots found by the correlation detector include at least two correct detections is high, about 96%. The probability that there are three correct



detections is lower, about 75%. The probability that all four are correct is only about 29%. The combined probability that there are three correct detections, and that the third (knoll) shot is among them is about 47%.

### 1.5 Independent Analytical Extension of the Reconstruction Test

The Committee sought to have the uncertainty in the test results reduced, particularly with respect to the 50% probability of the third (knoll) shot. Professor Mark Weiss and Mr. Ernest Aschkenasy of Queens College were authorized by the Committee to conduct an analytical extension of our acoustical reconstruction test. They first identified the objects in Dealey Plaza that caused each echo that appeared in the echo pattern we had found to indicate the possible third (knoll) shot. Next, they calculated how this echo pattern would be modified for receivers in the neighborhood of the microphone from which the echo pattern was obtained. Finally, they were able to show that 10 echoes of 12 in one of their calculated echo patterns matched with 10 sound impulses of 14 on the DPD tape recording - each one to an accuracy of  $\pm 1$  ms. The first of the 10 matching impulses was found to occur 7.6 sec after the first impulse indicating the first shot.

We examined the results of this independent study and judged both the technique and the parameters they used to be correct in every detail. We further concluded that the odds were only about 1 in 20 that their very precise match could have been achieved by chance - i.e., if the 14 sound impulses on the DPD tape were all noise and did not include echoes from a knoll gunshot. For this reason, we conclude that there is a 95% probability that there was a gunshot fired from the knoll at about 7.6 sec after the first one.

## 1.6 Findings

The results of our analysis of the tape-recorded evidence, together with the independent analysis of the echo-pattern match with the third (knoll) shot, permit the following findings:

1. The recorded sounds on Channel 1 of the Dallas Police radio dispatch system probably include the sounds of four gunshots fired in Dealey Plaza at about 12:30 pm on November 22, 1963.
2. The recorded gunshot sounds were sensed and transmitted by a police radio mounted on a motorcycle in the motorcade and positioned at distances ranging from 120 ft to 160 ft behind the Presidential limousine.
3. The first probable shot was fired at about 12:30:47 from the TSBD. The motorcycle position was then on Houston St. having only about 3 sec earlier slowed in preparation for the left turn onto Elm St. No shock wave indicating a supersonic projectile is seen as a precursor to the sounds of the muzzle blast, and none is expected, owing to the position of the motorcycle with respect to the expected trajectory of the bullet. Therefore, no conclusion can be drawn about whether this first acoustic disturbance was due to a rifle or to a sound impulse as loud as the report of a rifle. However, the sound did originate in the vicinity of the sixth floor of the TSBD.
4. The second probable shot was fired about 1.6 sec after the first one, also from the TSBD. At this time the motorcycle was just at the corner of Houston and Elm. Again, no shock wave is seen as a precursor to the sounds of the muzzle, and, again, none is expected.

5. The third probable shot was fired about 7.6 sec\* after the first one, and it was fired from behind the fence upon the "grassy knoll." At this time, the motorcycle was proceeding westward on Elm St. about 80 ft west of the intersection with Houston St. An apparent shock wave is seen as a precursor to the sounds of the muzzle blast. Inasmuch as a supersonic projectile would show such a precursor when the motorcycle is in this position, the third shot is probably from a rifle.
6. The fourth probable shot was fired about 8.3 sec after the first one, and it was fired from the TSBD. The motorcycle was on Elm St. about 90 ft west of the intersection with Houston St. An apparent shock wave is seen as a precursor to the sounds of the muzzle blast. Since the trajectory of the bullet would have been over the motorcycle, such a precursor would be expected for a rifle shot. Therefore, the fourth shot is probably from a rifle.
7. Additional police radio transmissions are intermittently recorded on the tape during and after the last two probable shots. These transmissions contribute a few electrical impulses to the noise background in which the impulses of gunfire are set. However, these noise impulses are too few in number to have a material effect on the accuracy by which the echo patterns of the acoustical reconstruction match the impulse patterns on the DPD tape.

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\*This time was obtained from the independent study of Weiss and Aschkenasy, and it differs by about 0.2 sec from the time obtained by our correlation detector.



These findings were presented at public hearing before the Committee on December 29, 1978. At that hearing, Officer H.B. McLain of the DPD testified that he had been riding his motorcycle on the left-hand side of Houston St., approaching Elm St. when he heard a single shot. After the hearing, he said that he remembered that he had turned on his siren shortly after the assassination and moved with the motorcade to the hospital. However, the appearance of McLain in photographs taken in Dealey Plaza just after the assassination suggests he did not leave the area with the motorcade. Unless McLain turned on his own siren, the absence of the siren sound on the tape is consistent with McLain's behavior as documented in photographs and it may have been his motorcycle.

Section 2 of this report describes the acoustical nature of gunfire - i.e., what could be expected after appropriate filtering of the Channel 1 tape, if it did indeed contain the sound of gunfire. Section 3 reports the procedures used to process the tape and the results of this processing. Section 4 describes the five screening tests, and Sec. 5 reports the results of the acoustical reconstruction of gunfire in Dealey Plaza. Section 6 discusses additional relevant sounds on the Channel 1 recording. Finally, Sec. 7 describes our review of an independent analysis of the match between our acoustical reconstruction and the sounds of the probable third shot.

## 2. NATURE OF RADIO-TRANSMITTED SOUNDS OF GUNFIRE

### 2.1 Overview

The discharge of a rifle creates two sources of impulsive sound — the sound of the muzzle blast and the sound of the shock wave shed from the supersonic bullet as it travels at a speed greater than the speed of sound. Figure 1 illustrates the difference in how these two impulsive sounds travel through the air. The shock wave, for example, has a direct path of travel that resembles a cone, while the sound of the muzzle blast spreads spherically from the source.

In addition to traveling at different speeds and in different ways, these impulsive sounds travel over several different paths before arriving at a receiver — in this case, a microphone. Figure 2 illustrates these paths. The first sound impulses to arrive travel in a straight line from the source to the microphone; this sound path is called the direct (D) path. It includes reflections ( $D_2$ ) from impulses traveling the direct path and striking the ground very near the microphone. Later sound impulses arrive at the microphone after first reflecting from large surfaces, such as building facades and the ground; these sound paths are called reflected (R) paths. Even later sound impulses arrive at the microphone after first diffracting from the corners of buildings and the edges of other large objects; these sound paths are called diffracted (T, M, L) paths. A weaker set of sound impulses, arriving at the microphone just after the direct arrival, are scattered first by small objects such as poles, people, and automobiles. After striking these scattering objects, these weaker sound impulses arrive at the microphone over the scattered (S, P) paths. Finally, reflections

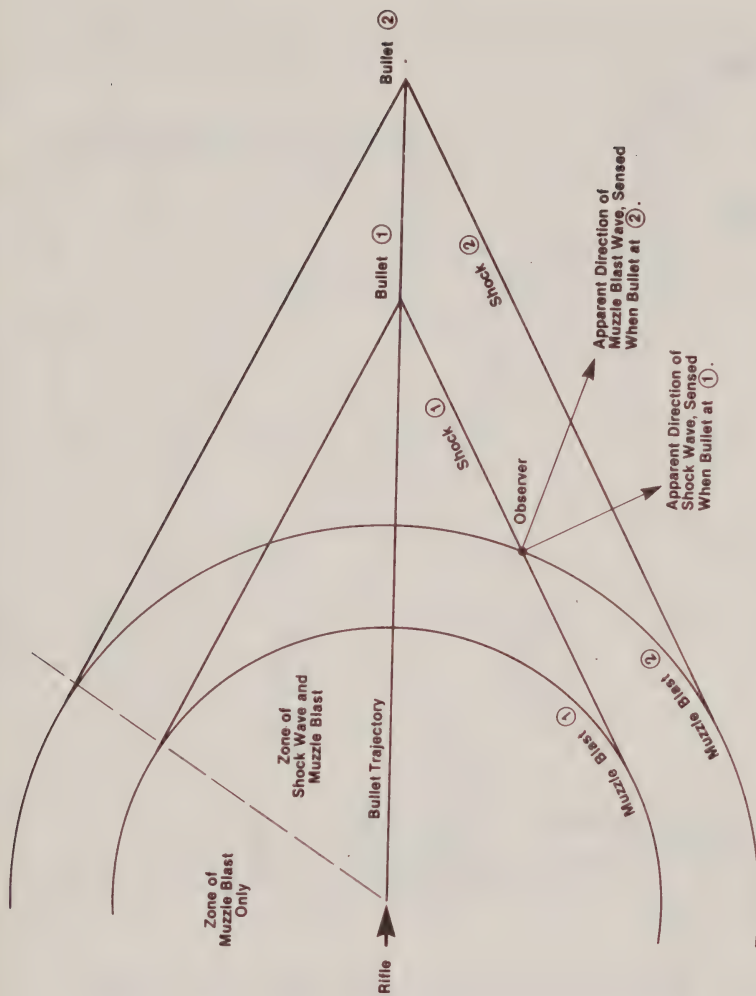


FIG. 1. LOCI OF MUZZLE BLAST AND SHOCK WAVES AT TWO TIMES AFTER FIRING OF BULLET.



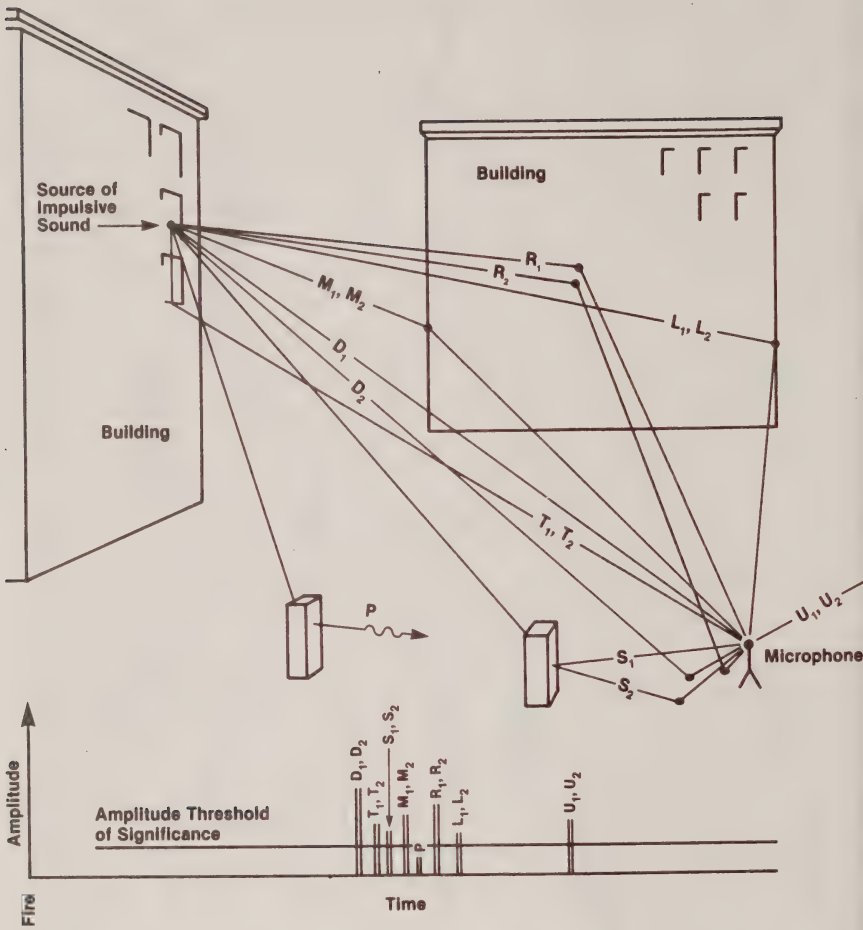


FIG. 2. ECHO PATTERNS CAUSED BY DIRECT, REFLECTED, DIFFRACTED, AND SCATTERED IMPULSIVE SOUNDS IN AN URBAN ENVIRONMENT.

from distant objects (U) arrive over various reflected paths, but these signals appear much later than those arriving by all the previously described paths.

All sound impulses arriving at the microphone that are loud enough to be heard over the environmental noise would be transmitted over the radio connected to the microphone. In this case, the environmental noise consisted primarily of the very loud, repetitive noise made by the engine of a moving motorcycle. This noise was found to be only about 10 dB lower than the loudest gunfire impulse recorded. Thus, only the very loudest gunfire sound impulses would actually be detectable above the engine noise.

The loudest sound impulses from gunfire are considerably louder than the loudness of speech, for which the radio was designed to operate. These loud impulses overdrive the radio circuitry. Because of the limiting circuits in the radio transmitter, very loud sounds are recorded in distorted fashion and appear as much weaker signals than they really are. In fact, despite the difference in loudness of signals traveling over the several paths illustrated in Fig. 2, each is recorded as having about the same amplitude.

After the sounds that were picked up at the microphone had been transmitted to the DPD radio receiver, the output of the receiver was recorded on a Dictabelt recorder. The circuitry of the receiver and the characteristics of the recorder also affected the transmitted signals. The recorded loudness of the sounds transmitted from the motorcycle radio with the stuck microphone were additionally affected somewhat by simultaneous transmissions from other officers in the motorcade. An FM radio receiver, such as the one in DPD headquarters, receives

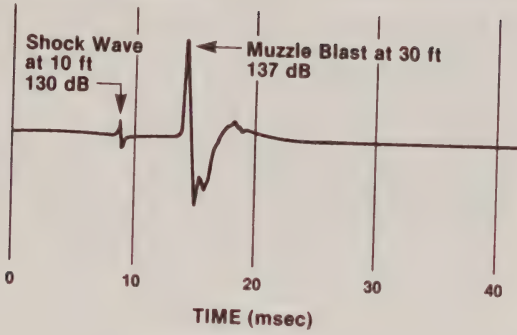
best from the transmitting radio having the strongest transmitted signal and can accommodate at the same time all receivers whose transmitted signal strengths differ by less than the receiver capture ratio.

Thus, the effects of severe environmental noise, of the limiting circuitry of the radio transmitter, of simultaneous radio transmissions, and of the recording characteristics of a Dictabelt recorder were such that any waveforms that would emerge from an analysis of the tape would be severely distorted. What these waveforms would look like without such distortion is illustrated in Fig. 3.

the upper portion of  
The waveforms shown in this figure were produced by a Mannlicher-Carcano with Western Cartridge Co. ammunition and picked up by a microphone positioned 30 ft from the muzzle and 10 ft to one side of the bullet's trajectory. The muzzle-blast waveform reveals a peak pressure impulse having a sound pressure level of 137 dB re  $2 \times 10^{-5}$  N/m<sup>2</sup>. For comparison, Fig. 3 also shows the corresponding waveforms for an M-1 rifle. Despite the differences in loudness (amplitude) from one weapon to the other, the shock wave and the muzzle blast can be seen to have characteristic shapes. Sounds processed from the Channel 1 tape could be expected to contain these shapes, but in distorted fashion. The shapes could be expected to be compressed in amplitude and to be accompanied by indications of overdriving of the radio circuits. They would also be accompanied by waveforms produced by the arrival of sound echoes from several sources, as described in the rest of this section.



## MANNLICHER-CARCANO



## M-1

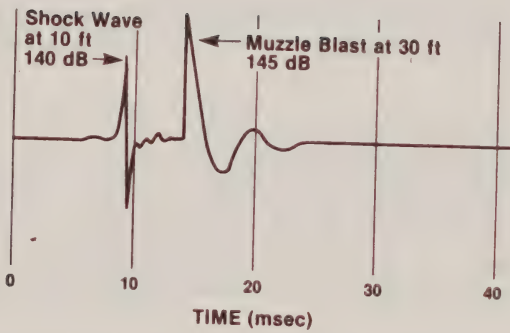


FIG. 3. MUZZLE BLAST AND SHOCK WAVEFORMS FOR MANNLICHER-CARCANO AND M-1 RIFLES.

## 2.2 Propagation Over the Direct Path

The distance from the muzzle in the TSBD to the nearest possible location of the motorcycle microphone is 60 ft and to the farthest possible location (at Houston and Main) is 260 ft. Loss in amplitude of the sound of the muzzle blast over the direct path is due principally to the spherical spreading of the sound as it travels outward from the source of gunfire. This weakening (attenuation) is accounted for by the quantity  $20 \log(D/30)$ , where  $D$  is the length, in ft, of the path of travel. The estimated loudness of the muzzle blast at the nearest possible motorcycle location is  $137 - 20 \log(60/30)$ , which is equal to 131 dB re  $2 \times 10^{-5} \text{N/m}^2$ . The estimated loudness of the muzzle blast at the farthest possible location is equal to 118 dB re  $2 \times 10^{-5} \text{N/m}^2$ .

Thus, both the muzzle blasts and the shock waves would be received over the direct path with sound pressure levels greater than the approximately 100-dB limiting sound pressure levels of the motorcycle radio. The result would be both an indication of overdriving the system and a compression of the recorded amplitude.

## 2.3 Propagation Over Reflected Paths

Ground reflections will always occur from below the microphone at the specular reflection point. Since the path length of the reflected path is only a few feet longer than for the direct path, the amplitude of ground-reflected sounds will nearly equal the amplitude of sounds arriving over the direct path.

Building reflections occur only when a building facade includes a specular reflection point for the source and microphone. This condition is met by the buildings on Houston St. for microphones located on Houston near Main St., and it is also met by the Post Office Annex for microphones located on Elm St. The path length for these reflections is the total distance from the source to the specular reflection point and then to the microphone. For microphones on Elm, the path length for reflections off the Post Office is about 1100 ft. The amplitude of such echoes is, therefore, estimated to be  $137 - 20 \log(1100/30) = 106 \text{ dB re } 2 \times 10^{-5} \text{ N/m}^2$  - still loud enough to cause limiting by the radio.

All reflected sounds, regardless of the reflecting surface, arrive at the microphone  $T$  seconds later than sounds traveling the direct path.  $T$  can be expressed as the ratio  $\Delta D/c$ , where  $\Delta D$  is the difference between path lengths in ft, and  $c$  is the speed of sound in ft/sec. At  $65^\circ\text{F}$ ,  $c$  is 1123 ft/sec, and at  $90^\circ\text{F}$ ,  $c$  is 1150 ft/sec. Sounds reflected from the Post Office occur about  $(1100-100)/1100$ , or about 0.9 sec later than the direct sounds.

## 2.4 Propagation Over Diffracted Paths

The amplitude of sound diffracted by a corner of a building can be estimated as follows.\* The ratio of diffracted sound pressure  $P_d$  to direct sound pressure  $P_0$  can be written as:

$$\frac{P_d}{P_0} = \frac{|F|}{\sqrt{6\pi k r_0}} \sqrt{\frac{\xi^2 + 1 - 2\xi \cos \theta}{\xi(\xi + 1)}} ,$$

\*See J.J. Bowman, T.B.A. Senior, P.L.E. Uslenghi, *Electromagnetic and Acoustic Scattering by Simple Shapes*, North-Holland Publishing Company, Amsterdam, 1969 (p. 274).



where  $\xi = r/r_0$ , the distances from the corner to the source and from the corner to the microphone, respectively. The angle between arriving and diffracted rays of sound is  $\theta$ , and  $k$  is the acoustic wavenumber. The function  $|F|$  is a number generally between 1 and 2.

There are many corners that can cause diffractions. The corner of the Records Building is typical. The amplitude of a sound impulse diffracted from its corner and received at Houston and Elm would be about 30 dB lower than that of an impulse arriving directly from the source. Since the amplitude of the direct-path sound of the muzzle blast near Houston and Elm is about 131 dB re  $2 \times 10^{-5} \text{ N/m}^2$ , the amplitude of the diffracted impulse will be about 101 dB re  $2 \times 10^{-5} \text{ N/m}^2$ , still loud enough to be somewhat limited by the radio and to be quite audible.

The total path lengths of diffracted sounds vary continuously between limits set by the direct path length and by the longest reflected path length. Thus, diffracted sounds should occur between the time of the direct arrival and the time of the arrival of the reflection from the Post Office.

## 2.5 Propagation Over Scattered Paths

Objects small enough so that  $kd \approx 2$ , where  $d$  is the nominal diameter of the object, will scatter sound in all directions. Substantial energy in the muzzle blast impulse is contained at frequencies near 500 Hz, where  $k = 2.8 \text{ ft}^{-1}$ . Thus, objects having a diameter of about 1 ft satisfy the scattering requirement. Such objects could be light poles, people, and motorcycles.

The loudness of scattered sound diminishes rapidly with increased distance from the scattering object. For this reason, only sounds scattered from objects fairly close to the microphone would be loud enough to be recorded.

Scattered sounds loud enough to be picked up by the microphone would arrive just following strong direct, reflected, and diffracted sounds. These scattered arrivals tend to increase the apparent time interval in which the primary signals arrive.

### 3. RESULTS OF EXAMINING AND PROCESSING THE DPD CHANNEL 1 TAPE

The first tape we received on May 12 from the Committee had a very scratchy overlay of needle noise, indicating that it was a very poor or multiple-generation dub of a recording. In July, the Committee gave us an electromagnetic tape recording that was identified as an original dub made by the DPD, as well as the original Dictabelt record. We then made our own dub on magnetic tape from the original Dictabelt record and compared our dub with that reportedly made by the DPD. We digitized both dubbed tapes - ours and that made by the DPD, plotted the outputs of the digitizing process, and found them to be virtually identical. In this way, we determined that the Dictabelt record was really the source of the data on the DPD-dubbed tape that we were using for analysis.

On the DPD Channel 1 tape, there is an interval of about 5-minute duration, beginning a little after 12:28 pm, in which the radio traffic on this channel is disrupted by a continuous transmission by some remote transmitter, presumably because its transmit button was stuck in the "on" position. As described in Appendix A, we input this entire interval into a digital computer, for subsequent detailed listening, viewing, and processing. This section describes the results of that examination.

#### 3.1 The Unprocessed Waveform Data

First, we made a high-resolution graphical plot of the waveform of this signal, at a scale of 5 in. per 1/10 sec, for detailed visual examination. The plot of the entire interval



comprises a roll of paper 12 in. wide by 234 ft long. Reductions of excerpts of this plot are reproduced in Fig. 4. In this figure and in the following discussion, time is noted in seconds from the beginning of the interval.

The first region to be noted in Fig. 4 is the area around 131 sec. This region is typical of the high level of motorcycle noise that characterizes the first 2 minutes of the data.

In the region of 132 to 133 sec, we can see the amplitude of the noise slowly drop. Later, when we discover the trajectory of the motorcycle as a by-product of detecting the sounds of shots, we find that the motorcycle was approaching the corner of Houston and Elm Sts. at this time. Therefore, this diminution of motorcycle noise is probably due to the slowing necessary to negotiate the 120° left turn at the corner.

At about 135.6 sec, we note a single large impulse of relatively long duration. Because of its length and because the region following this impulse is largely free of other impulses, such as the echoes normally associated with loud impulsive sounds, we feel that it is unlikely that this impulse represents the sound of gunfire.

The regions around 137.3 to 138.7 and 139.2 to 140.5 sec are notable for a number of brief, loud impulses. These impulse patterns, the first to appear in the data up to this time, were judged as potentially representing gunfire.

The region from 144.8 to 147.2 sec, which does not appear in Fig. 4, also contains a large number of impulses of similar character. Because this region is about twice as long as the



preceding ones, it was identified as possibly representing two separate impulse patterns, and, therefore, as potentially containing the sounds of two shots.

### 3.2 Spectrographic Analysis

Another way of portraying acoustical data is in the form of a spectrogram, in which the short-term spectrum of the signal is displayed as a function of time. Two example spectrograms from the region 141 to 148 sec are shown in Fig. 5. In this figure, time runs from left to right across the figure, and frequency from bottom to top. The energy at a given time and frequency is depicted by the blackness of the paper at that point.

The region from 141 to 144 sec is only noise. Just after 144 sec, a single loud click occurs, followed by a region of very faint speech (faint diagonal and horizontal smudges that change rapidly), clicks (thin vertical lines), and keying heterodynes (steady horizontal bars). The analysis into characteristic frequency components performed by the spectrograph permits us to recognize these events in a way not possible in the waveform patterns.

### 3.3 The Filtered Waveform Data

To be sure that the 137- to 147-sec region of the transmission contained the only transients of potential importance with respect to gunfire, we attempted to remove the effect of the motorcycle engine noise to see if it was obscuring other transients. For this purpose, we implemented on a high-speed digital computer a noise-canceling filter program that adapts to and subsequently cancels sound components that appear to

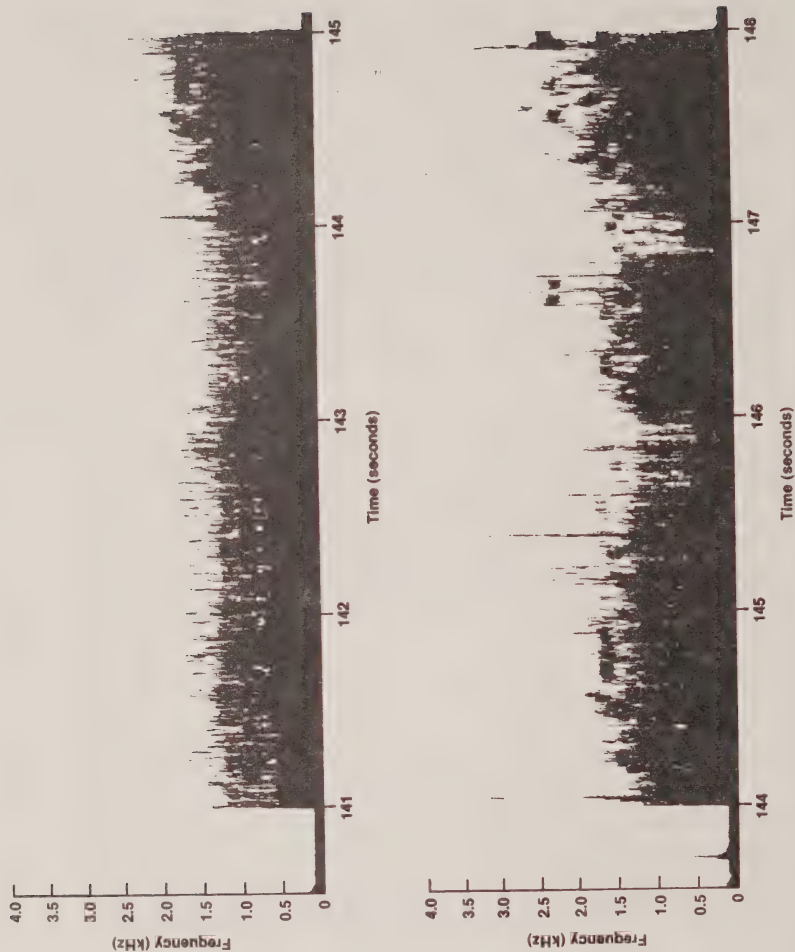


FIG. 5. SPECTROGRAMS FROM WAVEFORMS RECORDED FROM CHANNEL 1 TRANSMITTER WITH STUCK MICROPHONE.



be nonrandom (in this case, the periodic noise of the engine). This filtering algorithm is described in Appendix A. It was tested on a high-fidelity recording of motorcycle engine noise and was found to be very effective in removing it.

The adaptive filtering algorithm, when applied to the entire 5-minute segment of transmission, was not so effective. Figures 6 and 7 show the effect of filtering the waveform from 130 to 150 sec (overlapping the period for which the unprocessed waveform is shown in Fig. 4). The adaptive filtering removed hum and some low-frequency noise components, but the overall effect was not dramatic. Evidently, the distortions introduced by the radio transmitter, the original Dictabelt recording system, and the subsequent multiple playings of the Dictabelt had added non-random noise components that the adaptive filter was unable to remove.

Appendix A also describes other signal-processing techniques that were applied to these data in attempts to remove the motorcycle noise and to detect and track motorcycle engine speed. The results in both cases were negative.



FIG. 6. ADAPTIVE FILTERED WAVEFORMS RECORDED FROM CHANNEL 1 TRANSMITTER WITH STUCK MICROPHONE (130 to 141 sec).

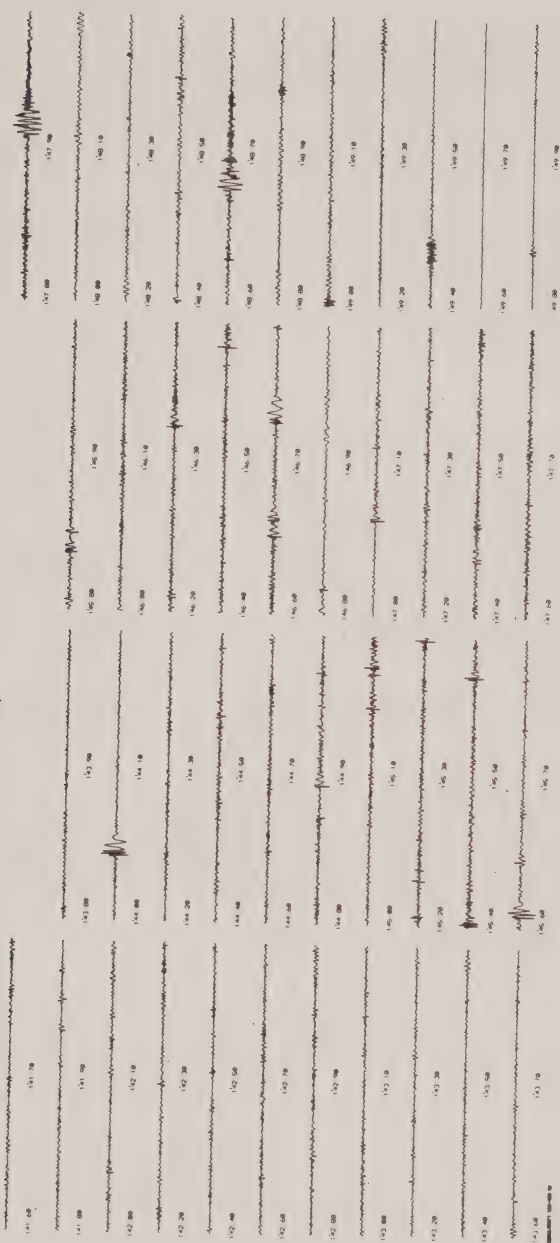


FIG. 7. ADAPTIVE FILTERED WAVEFORMS RECORDED FROM CHANNEL 1 TRANSMITTER WITH STUCK MICROPHONE (141 to 150 sec).

#### 4. SCREENING TESTS

As described in Sec. 1, the four impulse patterns on the DPD tape were subjected to five simple but necessary screening tests. If the patterns did not pass any of these simple tests, then they could safely be assumed to have been caused by something other than gunfire. If they were to pass these tests, they could not be assumed to be gunfire, but further analysis would be warranted. Essentially, the screening tests were designed to answer the following questions:

1. Did the impulse patterns occur at the same time as the assassination?
2. Were the patterns unique? In other words, were they caused by the same source, and did they appear only at this time and nowhere else on the tape?
3. Did the time intervals between the impulse patterns match that of other evidence of gunfire?
4. Did the shape of the impulses resemble the shape of impulses of recorded gunfire?
5. Was the amplitude of the impulses similar to that of recorded gunfire?

This section of the report describes how these questions were answered.

##### 4.1 Time of Occurrence

To determine the time of day when the impulse patterns were recorded on Channel 1, we examined the Channel 1 and the Channel 2 tapes. It is usual DPD practice for the Dispatchers on both channels to make frequent time annotations. In doing so, they



refer to two different clocks, which are synchronized at the beginning of each month and which are read out in full minutes only. An FBI study concluded that, towards the end of the month, the clocks could differ by as much as 1 minute. The allowable difference in the timing of events on Channels 1 and 2, therefore, was 60 sec.

The Channel 1 segment was a continuous recording that had no time annotations during the period of stuck transmission, but time annotations preceded and followed this period. The Channel 2 segment was an intermittent recording with frequent time annotations throughout. A stopwatch was used to time the events on both channels.

Figure 8 illustrates the results of stopwatch timing of the Gray Audograph record of Channel 2 events. Time annotations made by the Channel 2 Dispatcher are plotted against time on the stopwatch for the interval extending from 12:22 pm to 12:40 pm. Lines representing the least-square error fit are drawn through the time annotations. Note that the clock used by the Dispatcher is read out only in full minutes, and occasionally there is more than one annotation for the same minute.

For the events occurring before 12:30 pm on the Channel 2 tape, the slope of the least-square error fit is only 0.4, indicating intermittent operation of the recorder, which stops recording when there are no voice transmissions. At about 12:30 pm, the voice traffic picked up, and the Gray Audograph began recording continuously, as indicated by a least-square error fit slope of 1.0.

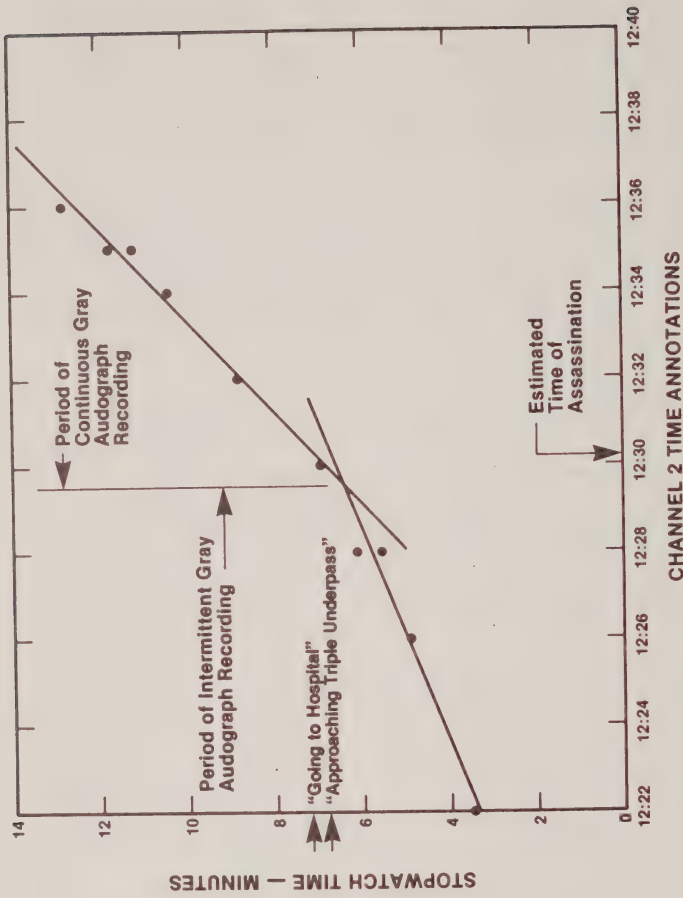


FIG. 8. LEAST-SQUARE ERROR FITS TO CHANNEL 2 DISPATCHER'S TIME ANNOTATIONS SHOWING TIMES OF DPD CHIEF'S RADIO TRANSMISSIONS.

The stopwatch time of two successive transmissions from Chief Curry are noted at the left of the illustration between the period extending from 6 minutes to 8 minutes. In the first, he notes that the motorcade is "approaching the triple underpass." After the Dispatcher notes the time as being 12:30, the Chief announces, "We are going to the hospital, officers." The assassination must have occurred sometime between Chief Curry's two voice transmissions. Since the slope of the least-square error fit changes at about 12:30, it is impossible to determine precisely the time on the Channel 2 clock when the assassination occurred. The best estimate is 12:30:12 pm.

Figure 9 illustrates the results of stopwatch timing of the Dictabelt record of the events on Channel 1. Here, the slope of the least-square error fit is 0.95, indicating that the recorder was running 5% too slow and, therefore, was compressing time slightly.\* The fact that the slope does not change over the course of the entire segment shows that the recorder operated continuously.

The onset of the first impulse pattern, or 'gunfire-like' event, on Channel 1 occurred at 12:30:47, Channel 1 time. Thus, the events on Channels 1 and 2 occurred within 35 sec of each other, well within the time difference allowable for this screening test.

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\*Frequency analysis of the power hum on the tape recording also indicated that the recorder had been about 5% slow. Since the hum could have been added when the tape was recorded from the dictabelt, this is not a reliable indication of the original recording speed.

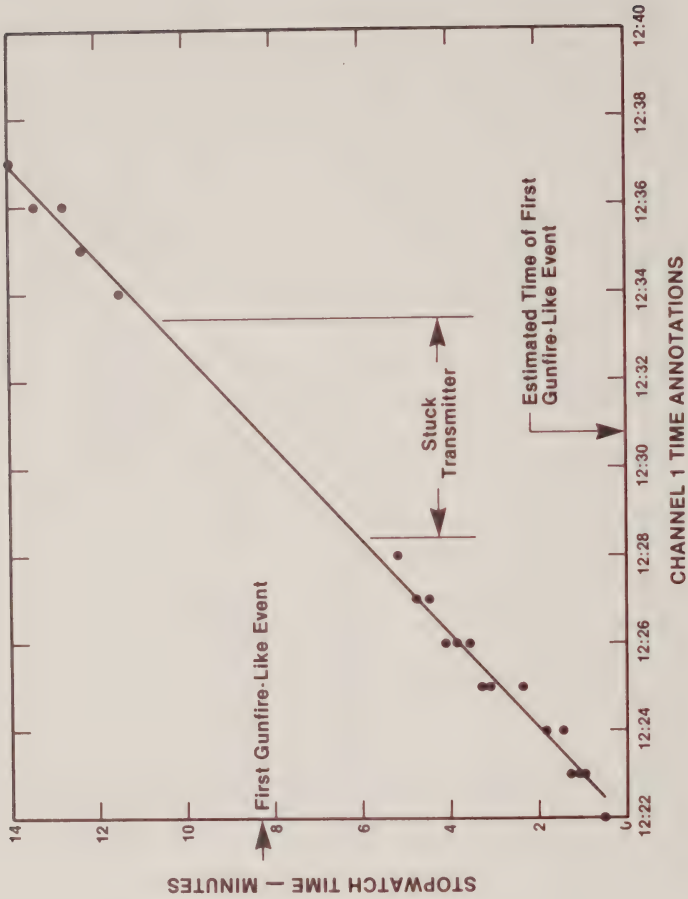


FIG. 9. LEAST-SQUARE ERROR FIT TO CHANNEL 1 DISPATCHER'S TIME ANNOTATIONS SHOWING TIME OF FIRST SET OF GUNFIRE-LIKE EVENTS.



#### 4.2 Uniqueness of the Impulse Patterns

If impulse patterns similar to those occurring at the time of the assassination were to be found anywhere else during the 5-minute recording of stuck transmission, then the patterns could safely be assumed to have been caused by something other than gunfire. Thus, we examined processed waveforms for the entire segment of stuck transmission, looking for impulse patterns similar to those already identified. During the course of this examination, only one other pattern was found. It began about 30 sec after the other four patterns and was comprised mostly of impulses apparently caused by radios keying in, attempting to transmit. This sequence, which lasted for approximately 4 sec, did not resemble the earlier impulse patterns well enough to have been caused by the same source.

#### 4.3 Time Span of the Impulse Patterns

If the impulse patterns were caused by the gunfire of the assassination, the time span they occupy would have to be at least as long as the evidence of time between bullet impacts as seen on the Zapruder film. On that film, bullet impact is judged to occur before frame 210 and again at frame 313, an interval of 103 frames. Since Zapruder's camera was judged to be operating at 18.3 frames per sec, the time span between these two events is 5.6 sec. The time span between the onset of the first impulse pattern and the onset of the fourth impulse pattern on the Channel 1 tape is 7.9 sec. When corrected for the fact that the tape recorder was running about 5% too slowly, the real time span is 8.3 sec.

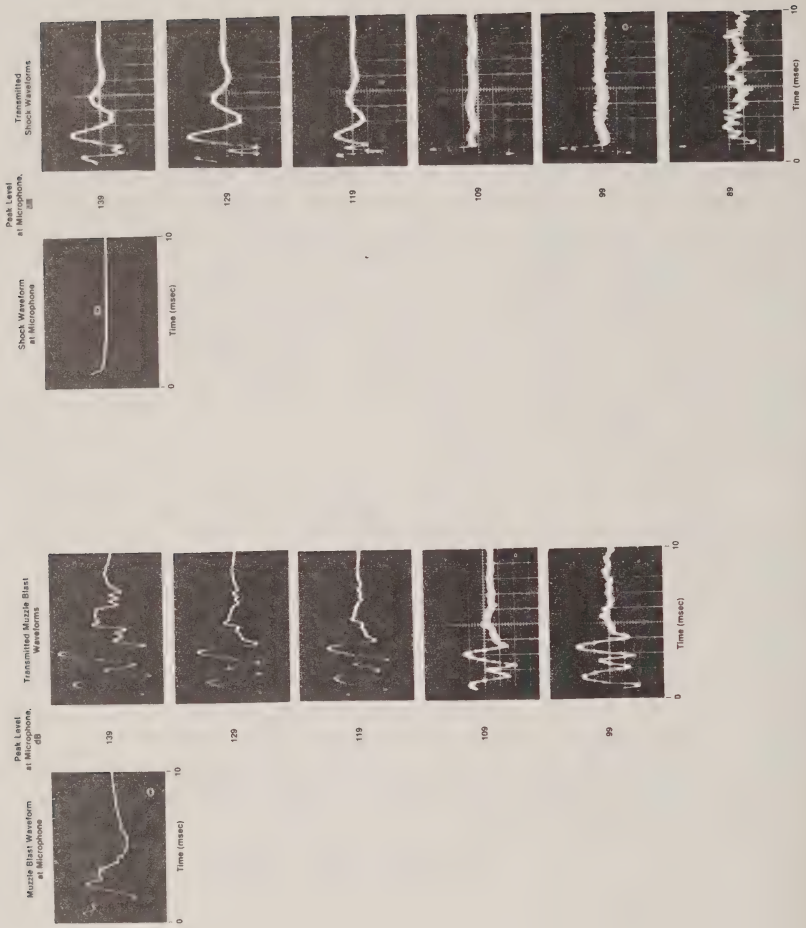


FIG. 10. MUZZLE-BLAST AND SHOCK WAVEFORMS TRANSMITTED BY A POLICE RADIO SIMILAR TO THE ONE USED BY DPD MOTORCYCLES FOR SEVERAL DIFFERENT LOUDNESSES.

#### 4.4 Shape of Impulses

If the impulse patterns recorded on the DPD tape were gunfire, the shape of the waveforms would have been distorted by the limiting circuitry of the radio transmitter. Figure 10 shows the nature of these distortions. At the left of the figure is a muzzle-blast waveform obtained from the test firing of a Mannlicher-Carcano rifle. This waveform has a double peak showing the direct arrival of the muzzle blast with a strong ground reflection immediately following. A tape recording of these impulses was fed through a transmitting and recording system similar to that used by the DPD. The characteristics of both these systems are discussed in Appendix B.

The series of five photographs of transmitted muzzle-blast waveforms shows the effect of the system's circuitry on impulse shapes - essentially, the louder the input signal, the greater the distortion. For example, the top photograph shows how the loudest signals, those arriving over the direct path, would be recorded. The signal that was input at 109 dB is a good example of what the reflection from a large and distant surface, such as the Post Office, would look like. Similar analysis of the shock-wave impulse at the right of the figure illustrates how the simple N-wave of the bullet is severely distorted when the input signal greatly exceeds the 100-dB limiting circuitry of the transmitter.

Comparison of these waveforms with the impulse patterns obtained from the DPD tape showed sufficient similarity that the possibility that the impulse patterns were caused by gunfire could not be ruled out.

#### 4.5 Amplitude of Impulses

Another characteristic of the waveforms that would have been affected by the circuitry of the radio transmitter if the input signal was as loud as gunfire was their amplitude. The recorded amplitudes of the sounds would be compressed in such a way that strong signals would appear to be weaker than they actually were, and weak signals in the same pattern would, therefore, appear stronger. As can be seen in Fig. 11, this compression is greatest for very loud signals, especially those with high-frequency content. For example, although all the signals were compressed, the amplitude compression of muzzle-blast waveforms above 100 dB was in every case less than that of the shock waves that are of higher frequency.

When the peak-to-peak difference in amplitude between two signals was 30 dB, they were recorded as having only a 20-dB difference (muzzle blast) or only a 10-dB difference (shock wave). As the amplitude of the input signal decreased, the difference in peak-to-peak level became more noticeable. This analysis gave us greater insight into the characteristics of the sounds originally recorded on the DPD tape. The signals on that tape also appeared to be compressed in amplitude, indicating that the sounds, as originally picked up at the motor-cycle microphone, may have been loud enough to have been caused by gunfire.



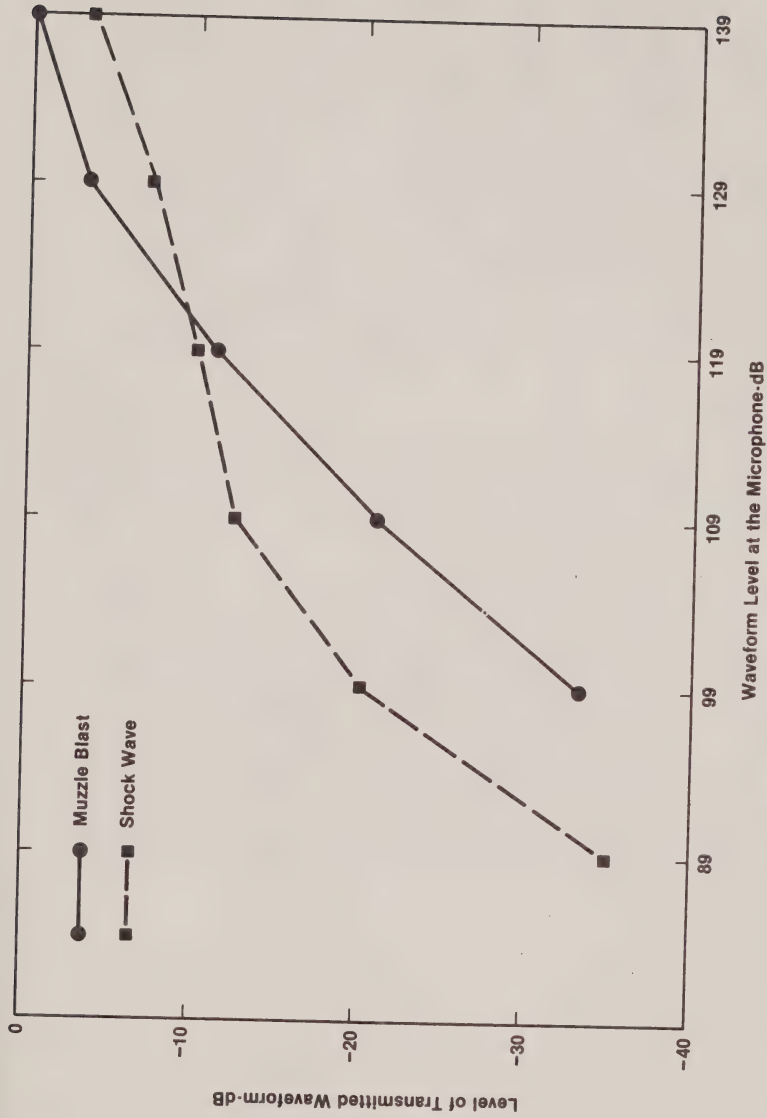


FIG. 11. LEVEL OF TRANSMITTED WAVEFORMS AS A FUNCTION OF WAVEFORM LEVEL AT THE MICROPHONE.

## 5. ACOUSTICAL RECONSTRUCTION IN DEALEY PLAZA

Because the five screening tests described in Sec. 4 had failed to disprove the possibility of gunfire having been recorded on the Channel 1 tape, a more rigorous test was required. The objective of the acoustical reconstruction, therefore, was to obtain several "acoustical fingerprints" of the sound of gunfire in Dealey Plaza to compare with the impulse patterns found on the Channel 1 tape. If any of the "fingerprints" matched, then the reconstruction would result in determining both the timing of the shots and the locations of the weapon and the target for each shot. Only those weapon and target locations indicated by available testimony were to be tested.

### 5.1 Nature of the Test

The most powerful test for the presence of weak signals that have many known features, but that are not clearly detectable because of background noise, is the correlation detection test. There are six distinct steps required to conduct this test.

*Step 1: Obtain acoustical measurements, called test patterns, of the signals to be detected.*

These test patterns are uniquely determined by weapon-target-microphone locations for each shot. There were 12 combinations of weapon-target locations, and they are listed in Table I. There were 36 microphone locations (3 arrays of 12 microphones), which, along with the four target locations, are illustrated in Fig. 12. Thus, 432 ( $12 \times 36$ ) unique test patterns were obtained. Six of these are illustrated in Fig. 13, where the logarithm of sound-pressure amplitude is displayed as a function of time, on a scale 16 in. to 1 sec.

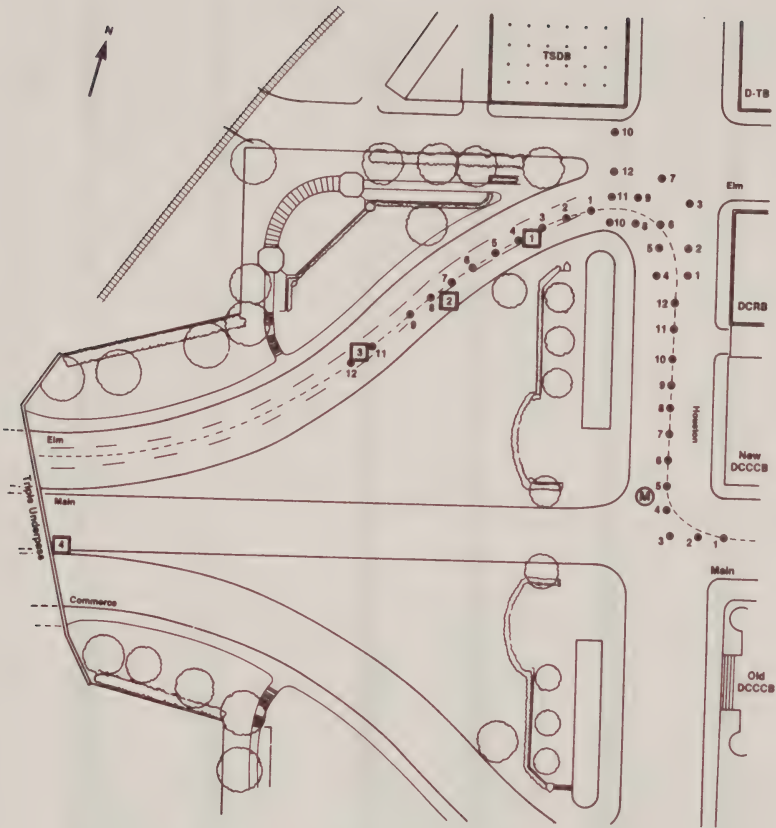


FIG. 12. MICROPHONE LOCATIONS AT DEALEY PLAZA.

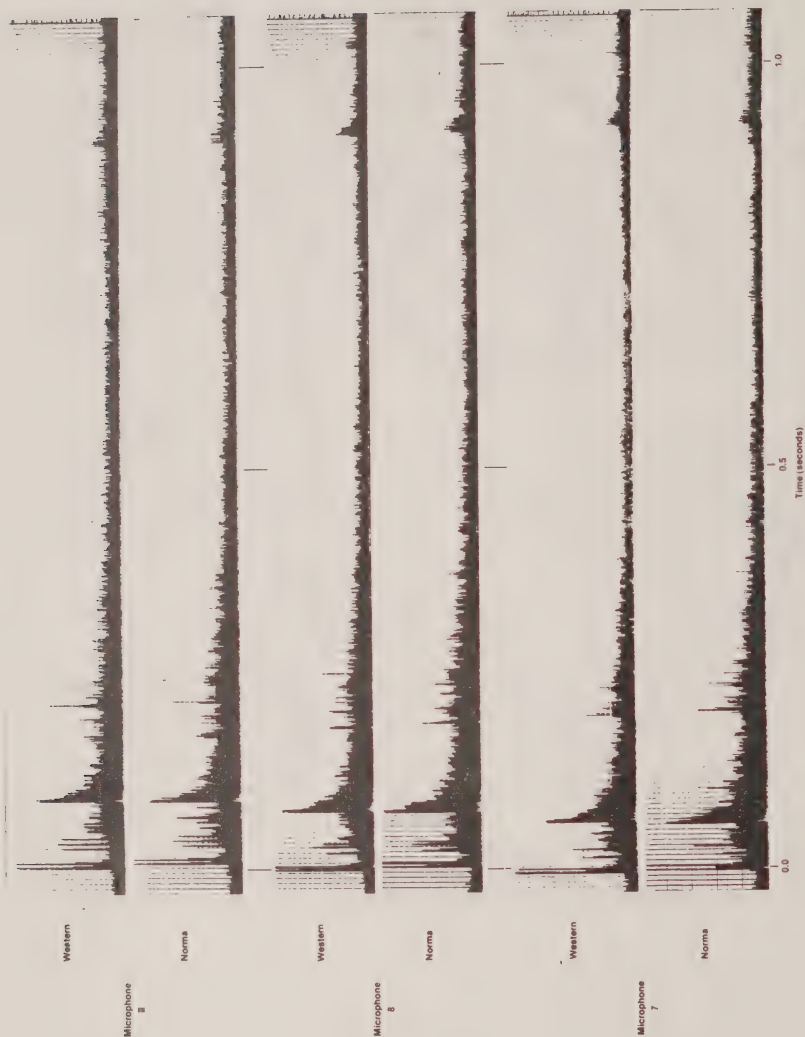


FIG. 13. COMPARISON OF TEST ECHO PATTERNS PRODUCED BY BOTH WESTERN AND NORMA AMMUNITION FIRED FROM TSD (MUZZLE WITHDRAWN) AT TARGET NO. 3 AND RECEIVED AT ARRAY 3, MICROPHONES 7, 8, AND 9.



TABLE I. SEQUENCE OF TEST SHOTS

Weapon Location	Target 1	Target 2	Target 3	Target 4
TSBD (Muzzle in plane of window)	Shot 1	Shot 3	Shot 6	Shot 10
TSBD (Muzzle 2 ft inside plane of window)	Shot 2	Shot 4	Shot 7	Shot 11
Knoll (Rifle)		Shot 5	Shot 8	Shot 12
Knoll (Pistol)			Shot 9	

*Step 2: Process the 432 unique test patterns into a like number of unique echo patterns or "fingerprints."*

Since the radio receiver compresses the amplitude of loud gunfire sounds into a narrow range of amplitudes, for comparison with the compressed impulse patterns, test-shot echoes that differ greatly in loudness must be compressed so as to differ only slightly in loudness after transmission by the radio. To achieve this compression, we selected only those echoes in a pattern having sufficient loudness to render them distinct from their neighboring weaker echoes.

This echo selection process is illustrated in Figs. 14 through 17, for test patterns of individual shots as recorded by three adjacent microphones. For each of these figures, the geometry of the test shot - i.e., the weapon-target microphone location sequence - can be reconstructed by referring to Fig. 12. As can be seen from that figure, 12 microphones were placed in 3 successive arrays along the route of the motorcade, beginning at the right of the figure at the corner of Houston and Main. The outputs of the microphones were recorded on channels having the same numbers as the microphones. Thus, the echo patterns

in Fig. 14 represent the sound of gunfire made by a Mannlicher-Carcano rifle, withdrawn 2 ft within the plane of the TSBD window, fired at the target located closest to the TSBD, and picked up by microphones 4, 5, and 6 located on Houston St. before the turn onto Elm.

In each of these four figures, 14 through 17, very loud echoes were selected from the echo patterns recorded by the three adjacent microphones. Those echoes judged to have been caused by some feature in Dealey Plaza - e.g., direct arrivals of shock wave and muzzle blast, ground and building reflections, etc. - were identified by dots that are connected by nearly vertical lines. The reason the lines are not vertical is that the microphones were far enough apart to receive the same sound at different times. When Fig. 14 is again used as an example, the slope of the vertical lines at the left of the figure indicates that microphone 6 was closest to the weapon location and was, therefore, the first microphone to pick up sound arriving by the direct path and by other short paths. The slope of the lines at the right of the figure indicates that microphone 4 was closest to a major reflecting surface, such as the Post Office, and was the first to pick up those echoes.

From the four groups of echo patterns shown in Figs. 14 through 17, we selected as "fingerprint" material the following number of echoes: 15, 14, 9, and 10. Again, selection of these echoes was based on their strength and on an understanding of how all the echoes would be compressed in amplitude by the limiting circuitry of the DPD dispatching system. The same procedure was used to select echo patterns from each of the 432 test patterns. Each echo pattern consisted of dots placed at

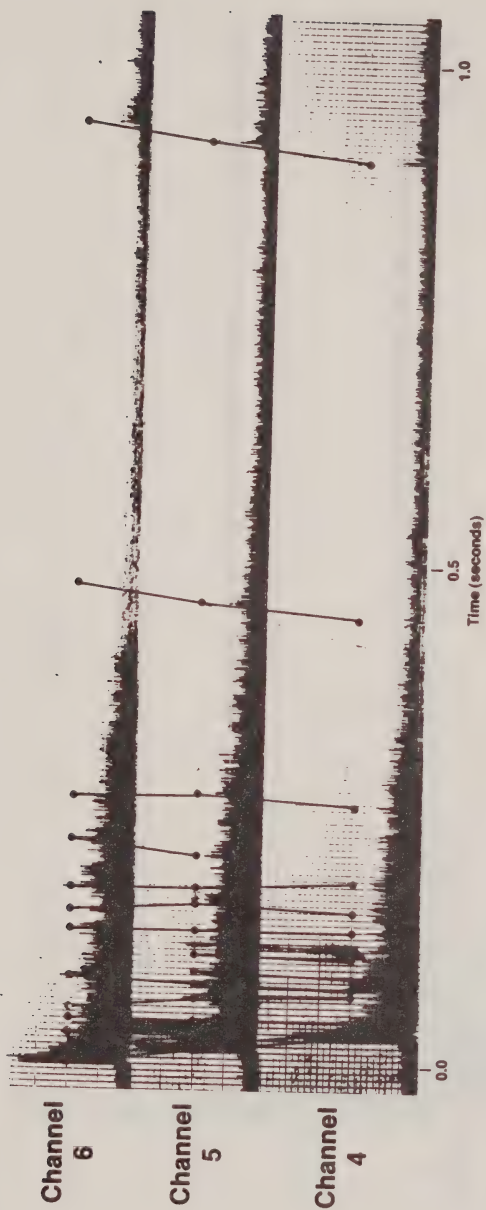


FIG. 14. ECHO PATTERN FOR SHOT 2 (TSBD, MUZZLE WITHDRAWN, TARGET NO. 1)  
RECEIVED AT ARRAY 2, MICROPHONES 4, 5, AND 6.

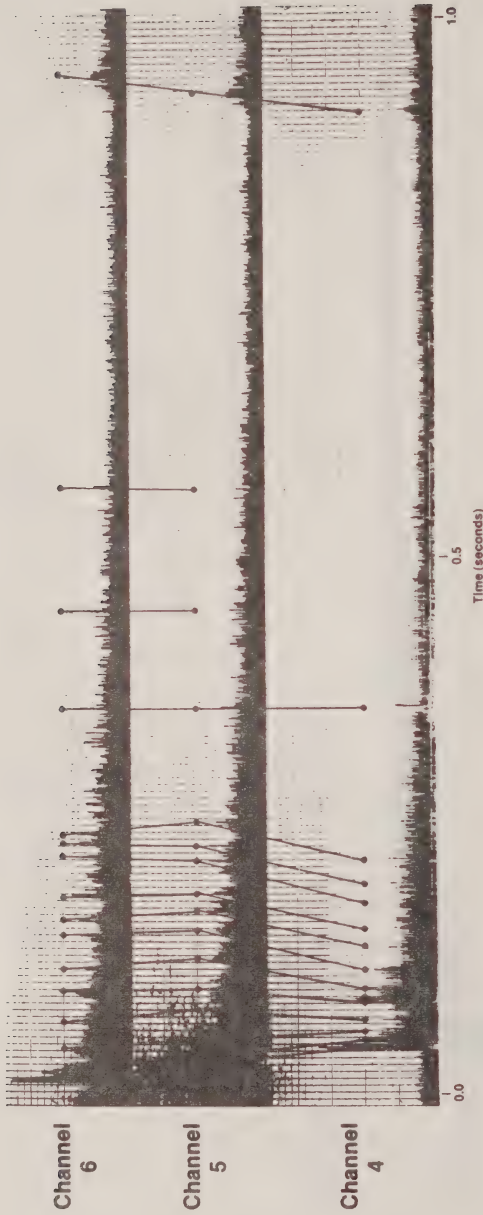


FIG. 15. ECHO PATTERN FOR SHOT 7 (TSBD, MUZZLE WITHDRAWN, TARGET NO. 3)  
RECEIVED AT ARRAY 2, MICROPHONES 4, 5, AND 6.



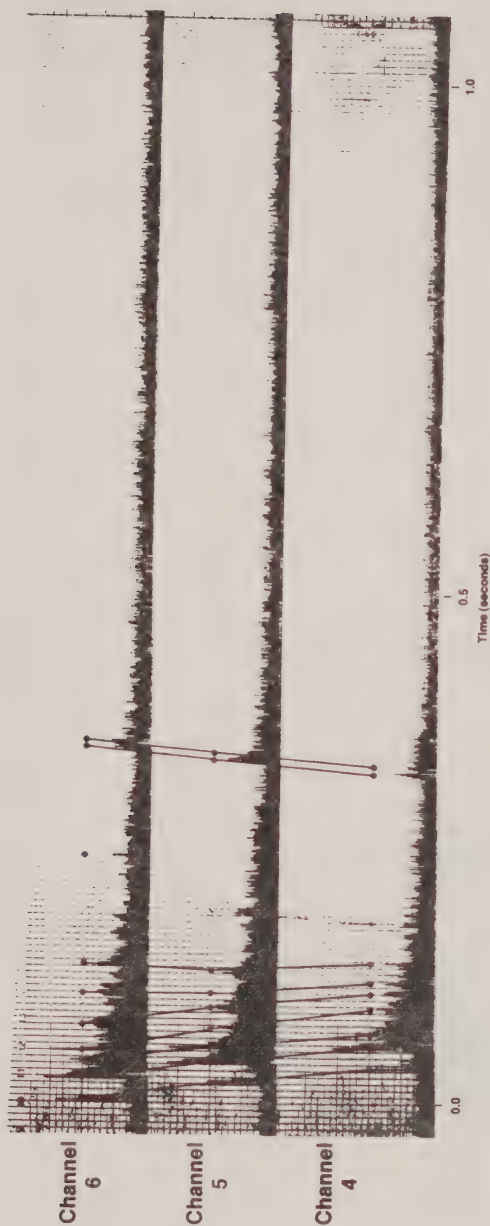


FIG. 16. ECHO PATTERN FOR SHOT 8 (KNOLL, TARGET NO. 3) RECEIVED AT ARRAY 3, MICROPHONES 4, 5, AND 6.

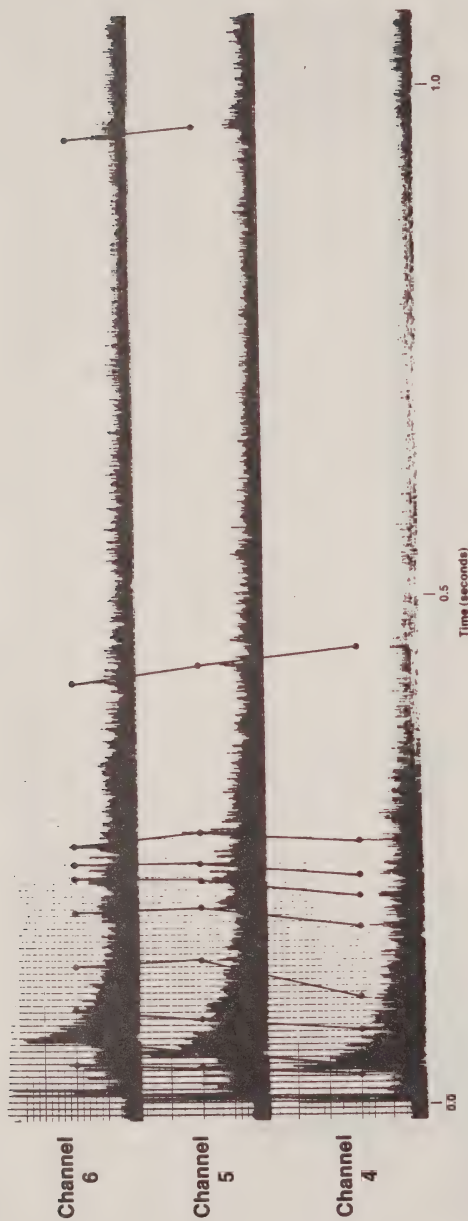


FIG. 17. ECHO PATTERN FOR SHOT 6 (TSBD, MUZZLE EXPOSED, TARGET NO. 3) RECEIVED AT ARRAY 3, MICROPHONES 4, 5, AND 6.

the time of each echo on a scale of 16 in. per sec, and there was an average number of 12 echoes on each echo pattern. Most echo patterns were of about 1-sec duration, or 16 in. long.

*Step 3: Process into impulse patterns the segment of the DPD tape recording that passed all five screening tests.*

The amplitude of the sounds on each segment was displayed in dB as a function of time, with each second of data occupying 16 in. of the display. The tape segment was subdivided for convenience into six separate segments of about 1-sec duration, each segment containing numerous sound impulses.\* About 4 sec of data were discarded, because there were no impulses occurring within them. All impulses louder than a threshold value were selected as members of the impulse pattern. This process is illustrated in Fig. 18, where 17 impulses were selected in a 1.2-sec-long segment of the DPD tape that begins at 137 sec from onset of the stuck microphone.

Above each numbered impulse in Fig. 18 is a pair of vertical lines separated from the time of impulse by 6 msec. The 12 msec between this pair of lines represents a window in which an echo from an echo pattern recorded during the reconstruction might acceptably occur. The reason for establishing such an acceptance window for the comparison between impulse and echo patterns is that the precise motorcycle position and, therefore, its position relative to the actual test microphone locations, was not known. This subject is addressed further in Sec. 5.2.

Three other impulse patterns are illustrated in Figs. 19 through 21. These correspond to DPD tape segments that begin at 139, 145, and 145.5 sec, and they contain 15, 11, and 8

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\*These segments included the four impulse patterns that passed the screening tests, with the fourth pattern divided into two segments, and one pattern that did not pass the tests.



FIG. 18. IMPULSE PATTERN FROM STUCK-TRANSMITTER RECORDING BEGINNING AT TIME 137 SEC.





FIG. 19. IMPULSE PATTERN FROM STUCK-TRANSMITTER RECORDING BEGINNING AT  
TIME 139 SEC.

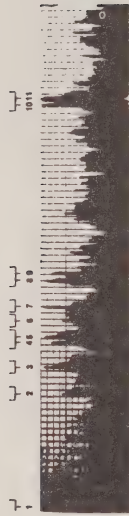


FIG. 20. IMPULSE PATTERN FROM STUCK-TRANSMITTER RECORDING BEGINNING AT TIME 145 SEC.



FIG. 21. IMPULSE PATTERN FROM STUCK-TRANSMITTER RECORDING BEGINNING AT TIME 145.5 SEC.

impulses, respectively. The two impulse patterns not illustrated contained 4 and 8 impulses, so that all six of the 1-sec segments averaged 10.5 impulses each.

*Step 4: Correlate each of the 432 echo patterns with each of the six impulse patterns for a total of 2592 separate correlation coefficients.*

The process of correlation, which obtains the measure of goodness of match between an echo pattern and an impulse pattern, is the essence of the correlation detector. The process is carried out by sliding the impulse pattern along the echo pattern until the maximum number of echoes occurs within the acceptable windows of corresponding impulses. This maximum number is called the number of matches. The correlation coefficient is the number of matches divided by the square root of the product of the number of echoes and the number of impulses; i.e.,

$$\text{correlation coefficient} = \frac{\text{No. of Matches}}{\sqrt{\text{No. of Echoes} \times \text{No. of Impulses}}}.$$

If there is an equal number of echoes and impulses, and if they all match when the two patterns are positioned at one relative time, then the match is perfect and the value of the correlation coefficient is unity (1.0). If there are extraneous impulses or echoes, such as may be caused by noise on the DPD tape or by an echo-acceptance threshold too low for the reconstructed sounds, then the match cannot be perfect and the correlation coefficient will be less than unity. If the echo pattern is not at all similar to the impulse pattern, there will be only one or two matches, and the correlation coefficient will be only a little larger than zero.



The correlation coefficients for all 2592 matches were calculated by determining the maximum correlation coefficient possible for each, after sliding each pair of echo patterns and impulse patterns relative to one another. The time of the first impulse on the impulse pattern was noted with respect to the instant that the microphone button became stuck.

*Step 5: Select all correlation coefficients having values greater than the detection threshold value.*

The detection threshold concept is necessary because we have observed that noise and experimental uncertainty tend to prevent any perfect correlations (unity value of the correlation coefficient). Whenever an echo pattern matches sufficiently well with an impulse pattern to produce a correlation coefficient higher than the threshold value, that echo pattern is said to pass the detection test. There are two possible meanings to be assigned to each passing of the test. First, if the impulse pattern was truly caused by gunfire, the passing is called a detection. Second, if the impulse pattern was *not* caused by gunfire – but rather by any other event capable of introducing noise in the radio – then the passing is called a false alarm.

Since impulse patterns that are truly caused by gunfire and mixed with radio noise cannot be expected to correlate perfectly with the test patterns, the detection threshold must be set low enough to ensure that no detections are missed. But the lower the detection threshold is set, the more false alarms that can be expected to occur. The analysis described in Appendix C indicated that random noise on one 1-sec segment of the DPD tape having about 12 impulses per sec will cause

fewer than 3.3 false alarms out of 432 echo patterns, provided the detection threshold is 0.6. This rate of false alarms was judged acceptable and was considered necessary to prevent misses.

*Step 6: Eliminate from the set of detections and false alarms the false alarms that can be identified.*

Since false alarms are caused by noise (unexplainable events), they may occur with echo patterns that represent weapon, target, and microphone positions that are obviously disjoint from actual detections and from false alarms that mimic actual detections. These events can be correctly identified as false alarms and eliminated from further consideration. Only independent (non-DPD tape) evidence can be used to identify those false alarms that may be mimicking detections.

## 5.2 Problems To Be Solved by the Acoustical Reconstruction Test

The acoustical reconstruction test had to be conducted in a safe and timely manner. Therefore, all conceivable weapon, target, and microphone locations could not be reconstructed. Five problems arising from this fact, and their solutions, are discussed here.

1. *Where in the motorcade was the motorcycle during the time span of the assassination, assuming that it was in the motorcade?*

The motorcycle would need to be within the confines of Dealey Plaza in order to pick up the sound of gunfire. From the corner of Main St. and Houston St. to the position of the President's limousine at the time the President's head wound was inflicted is a distance of about 460 ft. Since the pavement

widens greatly at the corner of Houston and Elm, about 150 ft needed to be covered twice, for a total linear distance of 610 ft. It was judged that there would be time from sunrise until noon to conduct four complete firing sequences. One of these would need to be a repeat to test for the similarity of two types of ammunition. Only 12 microphones could be used simultaneously, because of the need to keep 2 channels of a 14-channel tape recorder in reserve for annotation. Therefore, 36 microphone positions would have to cover a distance of 610 ft. Also, the streets in Dealey Plaza are about 40 ft wide, meaning that a motorcycle would likely be no more than about 18 ft from the center of a street. For these reasons, the microphones were spaced 18 ft apart, as illustrated in Fig. 12.

Because of the spacing of the microphones and lack of knowledge of the precise position of the motorcycle within the motorcade, it was judged that the motorcycle would, in the worst case, have been no more than 18 ft away from a microphone location. The most likely separations were accounted for in Sec. 5.1, Step 3, by the establishing of a  $\pm 6$ -msec acceptance window for matching echo and impulse patterns.

2. *Is live ammunition necessary in the acoustical reconstruction, and does the type of weapon and ammunition make a difference?*

In Sec. 2, we described how the shock waves generated by rifle bullets would be sufficiently loud at some microphone positions to become a significant part of an echo pattern. The speed of the bullet is important, because it determines the difference in time between perception of the shock waves and perception of the muzzle-blast waves. Therefore, it would

be best to use the same type of rifle and the same type of ammunition in the reconstruction as was used in the assassination. Evidence dictated use of a Mannlicher-Carcano rifle from the sixth floor of the TSBD, firing Western Cartridge Co. ammunition. The Committee supplied a similar rifle, but only 15 WCC rounds. It was necessary to use Norma ammunition for the first three sequences of rifle fire, while the fourth sequence was a duplicate of the third, with the exception of substituting WCC rounds for Norma rounds. No significant difference due to the type of ammunition was observed, as can be seen in Fig. 13.

Gunfire from behind the fence on the knoll had been alleged by some, although there was no evidence to indicate what type of weapon or ammunition might have been used. The greatest difference between echo patterns caused by two different weapons occurs whenever one fires a supersonic projectile and the other a subsonic one. For this reason, a Mannlicher-Carcano was used to produce the supersonic projectile and a 38-caliber pistol was used to produce the subsonic projectile. Since the knoll-to-target distances were only about 100 ft, it was not necessary to obtain great accuracy in matching test weapons with alleged assassination weapons in this case.

### *3. Where should the targets be located?*

Photographic evidence indicated that shots struck the President when his limousine was at the locations indicated approximately in Zapruder frames 200 and 313. Also, evidence indicated that a bullet may have struck the curb on the south side of Main St., near the triple underpass. Finally, our initial investigation of the tape indicated a shot may



have been fired when the limousine was near frame 160. For these reasons, four targets were selected, and their positions are marked on Fig. 12.

4. *Had any significant physical changes been made in Dealey Plaza?*

An important factor to be considered was the change over 15 years in the physical, and therefore acoustical, characteristics of Dealey Plaza. The absence of the crowd and cars was judged insignificant, because reflections of sound from these sources would constitute sufficiently weaker signals than those that would be selected for analysis. Thus, only two changes of importance had taken place: the introduction of the Hyatt Regency building a couple of blocks away as a possible reflector of sound and the absence of the building formerly located at the southeast corner of Commerce and Houston Sts.

Travel time for a sound wave to reach the Hyatt Regency and be reflected back to the microphone was estimated at 2 sec. Since the four impulse patterns had durations of no more than 1.1 sec each, the echo from the Hyatt Regency would not distort the data.

The sound waves that originally hit the missing building would have been diffracted by the corner of the building itself, with much of the sound energy being scattered. The reflected signal from this building would, therefore, have been sufficiently weak to have been swamped by the very strong reflection coming off the Post Office Building located at the southwest corner of the same streets.

For the purposes of reconstruction, therefore, Dealey Plaza was judged to have the same acoustical characteristics in 1978 that it had in 1963. However, when the test was being set up, we found that to shoot from the TSB at Target No. 2, it was necessary to shoot between two overhead signboards on a sign above Elm St. that was not there during the assassination. This sign could not be moved. The secondary echoes generated by the projectile shock waves impinging on these two signs apparently reduced the correlation coefficients for matches with test shots at this target, for only three were ever found to exceed the detection threshold, and these were identified as false alarms.

5. *How could the listening tests be accommodated?*

The experts used by Dr. Green\* to determine how earwitness accounts of the sounds of gunfire might be explained needed to hear each of the various test shots from at least four different locations. This requirement was met by our use of four identical sequences of test shots.

### 5.3 Results of the Acoustical Reconstruction Test

Of the 2592 maximum correlation coefficients determined by correlating the 432 echo patterns with the impulse patterns on six tape segments, 15 correlation coefficients exceeded the detection threshold value of 0.6. The time and weapon-target-microphone locations for each of these coefficients are listed in Table II. Inspection of the table shows that no correlations exceeded the threshold value for the two segments beginning at 136.20 sec and 146.30 sec after the time the microphone button became stuck. Fourteen of the 15 correlations that did exceed the

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\*See footnote, p. iv.

TABLE II. LIST OF ALL 15 CORRELATIONS BETWEEN IMPULSE PATTERNS OCCURRING IN SIX SEGMENTS OF THE DPD RECORD AND ECHO PATTERNS FROM 432 TEST SHOTS (2592 SEPARATE CORRELATIONS) HAVING A CORRELATION COEFFICIENT HIGHER THAN 0.5.

Beginning Time of First Impulse on Tape Segment <sup>§</sup>	Microphone Array and (Channel Number)	Rifle Location	Target Location	Correlation Coefficient**
136.20 sec	No Correlations Higher Than .....			0.5
137.70 sec	2 (5)	TSBD*	1	0.8
"	2 (5)	TSBD*	3	0.7
"	2 (6)	TSBD	3	0.8
"	2 (8)	KNOLL	4	0.7
139.27 sec	2 (8)	TSBD*	3	0.8
"	2 (6)	TSBD	3	0.6
"	2 (10)	TSBD	3	0.6
140.32 sec	2 (11)	TSBD*	3	0.6
139.27 sec	3 (5)	KNOLL	2	0.6
145.15 sec	3 (4)	KNOLL	3	0.8
"	3 (7)	TSBD*	2	0.7
"	3 (8)	TSBD	3	0.7
145.61 sec	3 (5)	TSBD	3	0.8
"	3 (8)	TSBD	4	0.8
"	3 (8)	TSBD*	2	0.7
146.30 sec	No Correlations Higher Than .....			0.5

<sup>§</sup>These times are tape times, and they are about 5% smaller than true time because the tape-recording process was about 5% slow.

\*Indicates Muzzle Withdrawn 2 ft from Plane of Window.

$$^{**}\text{Correlation Coefficient} = \frac{\text{Number of Echoes Matched with Impulses}}{\sqrt{\text{Number of Echoes} \times \text{Number of Impulses}}} \leq 1.0$$

threshold value occurred at four different instants of time, those beginning at 137.70 sec, 139.27 sec, 145.15 sec, and 145.61 sec. This result shows the possibility of four shots having been fired, each at one of the four times listed. The fifteenth correlation value to exceed the detection threshold occurred at 140.32 sec after the time the microphone button became stuck. This lone correlation will be identified as a false alarm in the next section and, therefore, does not indicate the possibility of a fifth shot. These times are all about 5% too small, because the tape-recording process was found to be about 5% slow (see Sec. 4.1).

#### 5.4 Conclusions about the Acoustical Reconstruction Test

It becomes clear upon examination of the weapon, target, and microphone locations for the several echo patterns that passed the correlation detection test at each of the four different times, that some are inconsistent with each other. Thus, some or perhaps all represent false alarms. Deciding which are false alarms was greatly facilitated by plotting the microphone locations for each of the 15 echo patterns against the time on the DPD tape when it correlated highly. This plot appears in Fig. 22, where zero on the time scale is taken to be the time on the DPD tape where high correlations were first detected. Zero on the distance scale is taken at the point where the Hughes film<sup>1</sup> shows a motorcycle to be, just as the Presidential

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\*Frames from the film taken by Robert Hughes, an amateur photographer, were introduced as evidence at the December 29 Hearing. This film was taken from the left-hand edge of Houston St., near Main St. With the camera pointed north up Houston St., the limousine is seen just disappearing around the corner after a left turn onto Elm St. A few frames later a motorcycle passes through the field of view, moving from right to left, proceeding north on Houston St.



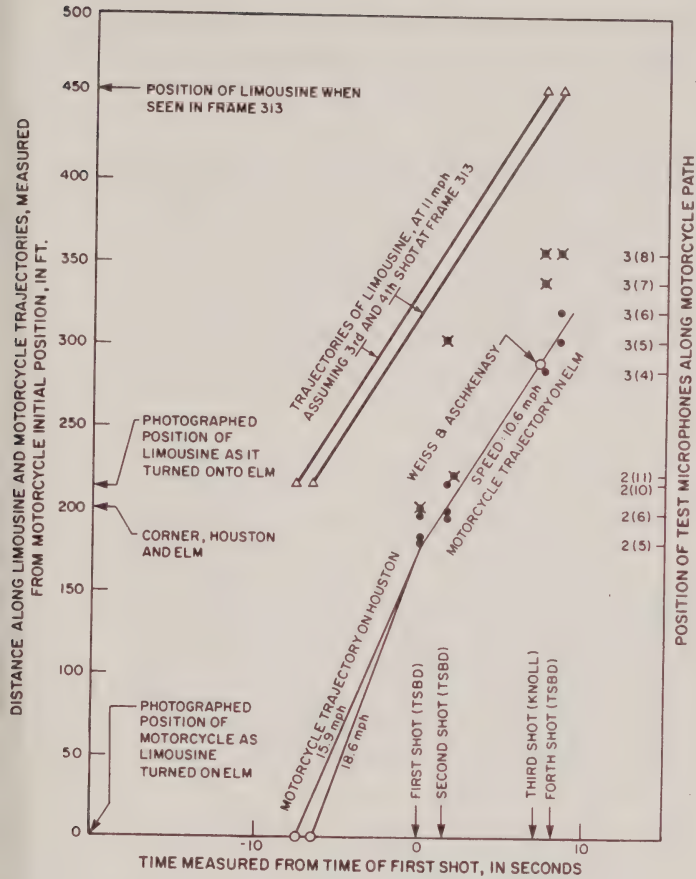


FIG. 22. MICROPHONE POSITIONS ALONG MOTORCYCLE ROUTE WHERE HIGH CORRELATIONS WERE OBTAINED, AS A FUNCTION OF TIME. ESTIMATED TRAJECTORIES OF MOTORCYCLE AND OF THE PRESIDENTIAL LIMOUSINE ARE SHOWN FROM THEIR POSITIONS INDICATED BY THE HUGHES FILM AT THE TIME THE LIMOUSINE TURNED DOWN ELM ST.

limousine is seen to disappear around the corner from Houston St. onto Elm St. This motorcycle position is marked M in Fig. 12. Distance is measured in feet from this point along the motorcade route.

Even a brief glance at Fig. 22 shows that the microphone locations that correspond to correlations at the three times after the first impulse tend to progress uniformly forward along the motorcade route. This conclusion can be quantified statistically by the chi-square test. If the motorcycle were not moving through Dealey Plaza at the time of the assassination, the distance along the motorcade route would be a meaningless coordinate, and the microphone locations for the correlations that exceed the detection threshold would occur at random. When the chart in Fig. 22 is partitioned into a  $2 \times 2$  table by separating time at 5 sec and distance at 250 ft, we find 1, 6, 8, and 0 correlations in the four sections reading from left to right, top to bottom. But the expected number of correlations to be found in these four sections, if the correlations occurred at random, are 4.2, 2.8, 4.8, 3.2. The value of chi-square for the observed and expected values is equal to 11.4. There is only 1 degree of freedom in this  $2 \times 2$  table, and the probability that this large value of chi-square could occur at random is less than 1%. Therefore, there is little doubt that the distance coordinate is meaningful, and we conclude that the motorcycle was moving through Dealey Plaza and did, in fact, detect the sounds of gunfire.

Looking at the information in Table II and in Fig. 22, we can determine that at least 6 of the 15 correlations above the detection thresholds are false alarms. These six false alarms are indicated in Fig. 22 with an X drawn over them, and they are:

1. The fourth entry in Table II that occurred at 137.70 sec is a false alarm, because it represents a rifle shot fired from the knoll at Target 4 near the triple underpass at a time when the limousine was near the position seen in frame 171. Thus, this shot was fired in a direction opposite to that of the logical target.
2. The entry in Table II that occurred at 140.32 sec is a false alarm, because it occurred only 1.05 sec later than earlier correlations also obtained from the TSBD. The rifle cannot be fired that rapidly. Since there are three correlations plausibly indicating the earlier shot, the one occurring 1.05 sec later must be a false alarm.
3. The fourth entry in Table II that occurred at 139.27 sec is a false alarm, because the motorcycle would have had to travel 130 ft in 1.6 sec (55 mph) to gain that position.
- 4,5,6. The second and third entries at 145.15 sec and the third entry at 145.61 sec are false alarms, because the motorcycle would have had to travel at 16 mph to gain the indicated position of only 70 ft behind the limousine at the time of the last shot. The motorcycle noise level (see Fig. 4) decreased by about 10 dB just 3 sec before the time of the first correlations, indicating a slowing to negotiate the 120° turn onto Elm St. The motorcycle noise level did not increase for the next 13 sec, so it could not have increased speed to 16 mph and maintained it.

There remain nine correlations that exceeded the detection threshold, and they occur at four different times:

- Group 1. 137.70 sec - four correlations with test shots from the TSBD at Targets 1 and 3.\*
- Group 2. 139.27 sec - three correlations with test shots from the TSBD at Target 3.
- Group 3. 145.15 sec - one correlation with a test shot from the knoll at Target 3.
- Group 4. 145.61 sec - two correlations with test shots from the TSBD at Targets 3 and 4.

There is no other acoustical evidence that would help to determine which of the remaining nine correlations are false alarms, if any. Clearly, at least one of the first two groups of correlations and at least one of the second two groups of correlations must contain detections, because the order found in the data would not likely have occurred by chance. The probability that two detections have been achieved and that one is near 138 sec and the other near 145 sec is at least 95%.

However, the expected number of false alarms to be found when testing four different impulse patterns is 13 (see Appendix C), and only six have been found. Therefore, it is not unreasonable to expect that there are seven more, although that would be the largest number possible since at least two of the remaining nine are probably detections. The best that can be safely assumed is that each of the nine remaining correlations is equally likely to represent a detection or a false alarm.

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\*Possibly because of the presence of an overhead sign that interfered with test shots at Target 2, no correlations were found with that target.



On the basis of this judgment and the assumption that each of the 15 events are independent, the probabilities of several different outcomes can be calculated.

The probability that at least two shots have been detected is 96%, the probability that at least three shots have been detected is 75%, and the probability that four shots have been detected is 29%. The individual probabilities that shots occurred at each of the four times at which correlations exceeded threshold are 88%, 88%, 50%, and 75%, listed in order of increasing time. The combined probability that there were three shots and that the third (knoll) shot was one of them is 47%.

Our correlation detector that located the origin of gunfire also located the position of the radio that transmitted the gunfire sounds. It is important to show that the motorcycle trajectory determined by the detections is compatible with independent evidence about a motorcycle trajectory. The necessary independent evidence to show this compatibility is partially obtained from the positions of the Presidential limousine and a motorcycle shown in the movie taken by Hughes (see footnote on p. 62). This movie shows the limousine just turning onto Elm St. just before a motorcycle passes that has turned onto Houston St. from Main St. We estimate that the motorcycle was at point M (Fig. 12) at that sighting. We estimate that the limousine was at the position of microphone 2(9) (Fig. 12) at that sighting, 215 ft north on Houston St.

The position of the limousine at the instant of the President's head wound is shown in Fig. 22 at two different times, assuming that either the third or the fourth shot

struck. Photogrammetric determination of the limousine speed on Elm St. was about 11 mph. The limousine's positions at times before the head wound is shown by the two parallel lines projected backward, having a slope equal to 11 mph. The two times at which the limousine position is equal to its assumed position when the motorcycle was at point M are shown in Fig. 22. We find that these times were either 6.5 sec or 7.2 sec before the first shot was fired. The motorcycle position at either one of these two times was 180 ft away from its position when the first shot was fired, according to the results of our correlation detector. Therefore, its average speed north on Houston St. would be either 15.9 mph or 18.6 mph, depending upon whether the third or fourth shot caused the head wound. These two trajectories are shown in Fig. 22 also.

A precise motorcycle location at the time of the third shot, calculated by Weiss and Aschkenasy, was found to be 5 ft southwest of microphone position 3(4). This location is marked in Fig. 22. The straight line that passes through this point, and best fits the eight other microphone locations that produced echo patterns indicating the other three shots, is plotted in Fig. 22. This line is the estimated motorcycle trajectory on Elm St., and it indicates an average speed of 10.6 mph.

The complete motorcycle trajectory shows that the motorcycle traveled north on Houston St. at about 17 mph. It slowed to about 10 mph at a point about 40 ft south of the corner at Elm St., and then continued west on Elm St. at about 10 mph. This single diminution of speed is compatible with the single

diminution of motorcycle noise about 3 sec before the first shot is heard (see Fig. 6). We conclude that the motorcycle trajectory determined by the gunfire detections is compatible both with the positions of a motorcycle shown in the Hughes film and with the loudness of the motorcycle noise as transmitted to the Dispatcher.

## 6. ADDITIONAL RELEVANT SOUNDS ON THE DPD CHANNEL 1 TAPE

In an attempt to gain as much acoustical evidence as possible, the Channel 1 tape was examined for other relevant sounds. These other sounds consisted primarily of the tolling of a bell, the noise of sirens, and voice and other transmissions.

### 6.1 Bell

The toll of a bell can be heard faintly at about 152.5 sec. It was hoped that the location of the bell, and therefore of the radio transmitter, could be obtained by acoustically identifying the bell.

The energy spectrum of the 1/3-sec segment containing the bell sound is shown in Fig. 23. Several peaks evident in the spectrum are harmonically related. The fundamental frequency of this series of spectral peaks is 210 Hz. The spectral peaks are marked according to the usual nomenclature used to describe overtones of a carillon bell. The fundamental tone is called the hum note. The second harmonic, called the strike note, is at the nominal pitch of the bell - in this case, 420 Hz. The third harmonic is a fifth above the strike note. Higher harmonics are strong at 1050 Hz and 1470 Hz. The minor third above the strike note is strong, and this fact is characteristic of carillon bells.

The tape-recording system was found to be about 5% slow, when the time annotations were measured with a stopwatch (see Fig. 9). Therefore, the apparent pitch of the tone would have a frequency of  $(1.05) (420) = 441$  Hz.



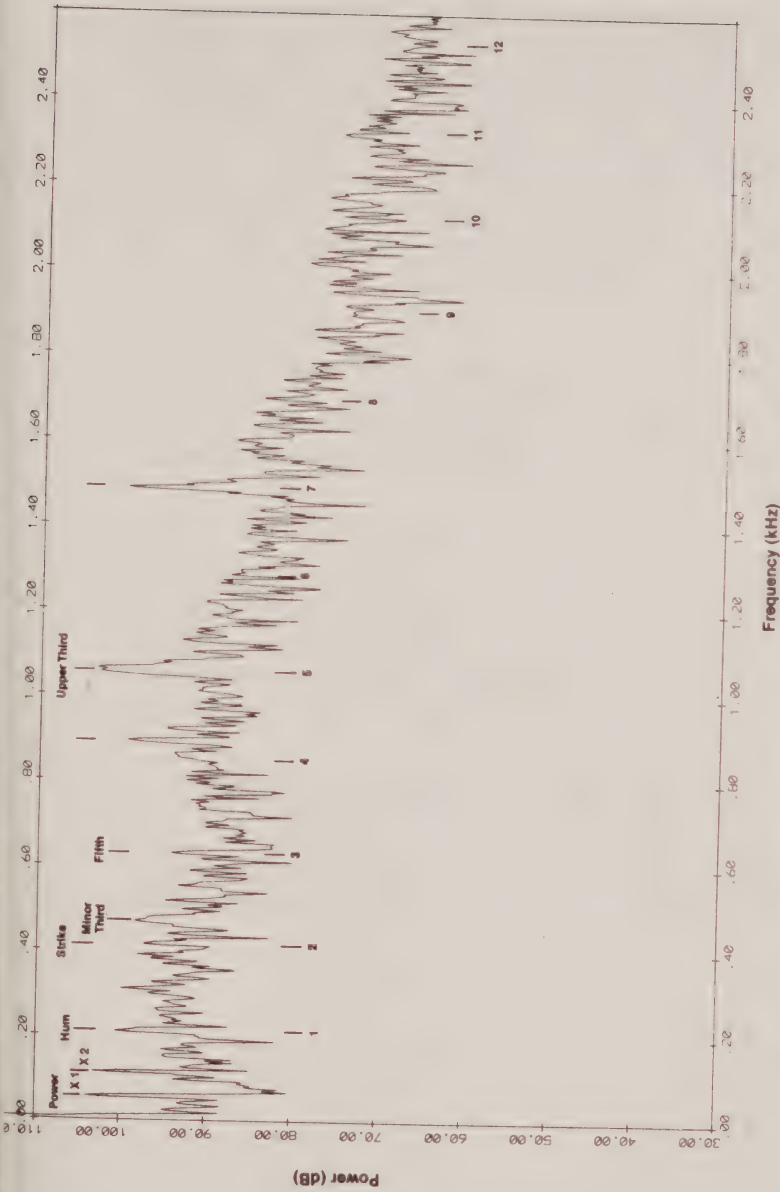


FIG. 23. ENERGY SPECTRUM OF TAPE SEGMENT CONTAINING THE SOUND OF A BELL.

Careful investigation by the Committee staff did not discover any such bell within earshot of Dealey Plaza. During the acoustical reconstruction tests in Dealey Plaza, the sounds of railroad locomotive bells were recorded and subsequently analyzed. These sounds bore no similarity to the carillon-like sounds of the original recording.

We concluded that the bell sound on the Channel 1 tape recording must contain sounds from at least one transmitter not in Dealey Plaza at a time near 152.5 sec.

## 6.2 Sirens

The region from 263 to 300 sec of the stuck transmission contains the sounds of a number of sirens. The effect is not that of a microphone being carried on a vehicle with a wailing siren, but rather of many vehicles with sirens coming and going around the microphone.

## 6.3 Voice and Other Remote Transmissions

Starting just after 264 sec, a voice transmission says, "Anybody know where 56 is?" The quality of this voice is such that it sounds as if it may have been picked up by the open microphone of the stuck transmitter, rather than having come from a second transmitter on the same channel, but it is impossible to tell for sure.

In many other cases, there are brief voice signals from other remote transmitters. Sometimes these signals are too faint to be understood (such as the voice signal shown in the spectrograms in Fig. 5), sometimes they are loud but very distorted, and sometimes they are quite intelligible. These

competing transmissions are often, but not always, accompanied by heterodynes, which are tones caused by slight differences in frequency among the competing transmitters. Many times these remote transmissions are very brief (around 0.1 sec) "beeps" with no voice, signifying attempts to make one's desire to use the channel known. This beeping is common practice on a shared radio channel.

## 7. REVIEW OF AN INDEPENDENT ANALYSIS OF THE POSSIBLE THIRD SHOT

Owing to the uncertainty about the possible third shot found in our study, the Committee sought an independent analysis. Professor Mark Weiss and Mr. Ernest Aschkenasy of Queens College conceived of an analytical extension to our work that could determine with more certainty whether or not the match between one echo pattern from our acoustical reconstruction with one impulse pattern on the DPD tape indicated a third shot. At a meeting on October 24, we contributed to the design of this analytical work.

Their analysis was conducted as follows. First, they made a graph of the waveform of the echo pattern we recorded on microphone 3(4), when a rifle was fired from the knoll at target no. 3 (see Table II). From this graph, they identified the 22 loudest individual echoes within the pattern. Then, they identified the 22 echo-producing objects within Dealey Plaza by noting which objects corresponded to observed echo delay times - i.e., by identifying rifle-to-object-to-microphone sound paths that would account for the times each of the 22 echoes were received by microphone 3(4).

Next, they analytically moved the position of microphone 3(4) several times by calculating for each time what the echo pattern would have looked like if that microphone used in the acoustical reconstruction had been located in these other positions. After a time, they found that a position about 5 ft southwest of the actual location of microphone 3(4) represented the true location of the motorcycle at the instant the muzzle blast would have been received by its radio. Then they calculated the delay times for each of the 22 echoes received at



that point as it moved down Elm St. at 11 mph. The resulting series of echoes was found to match with the sound impulses on the DPD tape beginning at about 144.9 sec (see Table II).

Weiss and Aschkenasy found that 12 of the 22 echoes were loud enough to exceed a threshold that they felt excluded most of the weak echoes that would not be audible in the DPD tape. They found that 10 of these 12 echoes occurred within  $\pm 1$  msec of the occurrences of 10 of the 14 impulses on the DPD tape that were loud enough to exceed a threshold. The value of the correlation coefficient that represents this match is 0.77. This value exceeds the threshold value of 0.60 for which we accept a correlation as possibly indicating a shot.

The probability that a false alarm will be produced by the correlation scheme used by Weiss and Aschkenasy is much lower than it is by our correlation scheme, because in our analysis we counted echoes that occurred within  $\pm 6$  msec of the occurrence of impulses on the DPD tape. We were required to count echoes occurring within this larger time interval, because of our initial uncertainty of the true motorcycle location.

We computed the probability that Weiss and Aschkenasy could have obtained by chance their good match between their calculated echo pattern and the impulse pattern on the DPD tape. We observed that they obtained 10 matches, to a precision of  $\pm 1$  msec, out of 12 test echoes, with 14 impulses in a 320 msec time span. We note, however, that the 12 test echoes were contained in two time intervals of 90-msec total duration. These two intervals were separated by a span of about 230 msec in which no echoes appeared. Because an echo was counted if

it occurred within a 2-msec time window, there were 45 possible windows in which echoes may occur. Since one of the 10 occurrences can always be matched simply by adjusting the origin of the time scale, there are only 9 independent occurrences. The probability of obtaining by chance 9 or more out of 12 echoes occurring within any specific 14 time windows out of a possible 45 is equal to  $3.13 \times 10^{-4}$ . This probability of obtaining by chance as good a match as was obtained on a single try is given by the hypergeometric probability function. However, they were required to try not once, but about 180 times. This is because the motorcycle could have been anywhere in a 40-ft by 18-ft rectangular space. Since a significantly different pattern would be calculated by them for each different 2-ft by 2-ft square, they were required to examine about 180 different patterns. The probability of obtaining just one match by chance in any of 180 independent tries is equal to  $5.3 \times 10^{-2}$ , or about 5%. Therefore, the probability that they obtained their match because the two matched patterns were due to the same source (gunfire from the knoll) is about 95%.

## APPENDIX A. COMPUTER SIGNAL PROCESSING

Many of the analyses of the acoustic data were performed on digital computers. In this appendix, we describe these processing methods.

### A.1 Digitizing

When played from a magnetic tape, sound is in the form of a continuous electrical signal. For it to be amenable to processing by a digital computer, its voltage must be sampled, or read, at frequent intervals. The voltage must then be expressed as a digital quantity. The sampling rate must be sufficiently rapid to preserve the high-frequency components of the signal; sampling rates of 10,000 times per sec and 20,000 times per sec were used in this work. The signal must then be digitized with an analog-to-digital converter; the resulting series of numbers is stored on a computer disk-file.

### A.2 Interactive Playback and Display

Once the signals have been digitized, waveforms can be graphically plotted on a computer display; the signals may also be reconverted to sound by a digital-to-analog converter. Interactive signal display, editing, and playback programs make it possible to display any time interval of the signal and to convert it back to a sound signal for listening. This interactive process of observing portions of the signal waveform and simultaneously listening to it is very valuable.

### A.3 Plotting

In addition to showing portions of the signal waveform on the computer display, we also used the computer and a graphical plotter to make pen-and-paper drawings of the signal waveforms. These high resolution plots, usually made with a scale of 5 in. per 1/10 sec, provide a permanent record of the signal. Examples of these plots are shown in Sec. 3 of this report.

### A.4 Signal Enhancement

Computations performed on the digitized signal can produce filtered versions and other representations of the signals. Digital signal processing can accomplish the same kinds of filtering that can be performed in the analog domain, and it can accomplish new kinds of filtering that are impossible by conventional means. Several different kinds of signal processing were performed on the data.

#### *Enhancement by Adaptive Noise-Canceling Filter*

An adaptive noise-canceling filter differs from fixed filters in that it automatically adjusts its signal-processing characteristics by means of an algorithm that allows it to predict certain noise components. The particular filtering process\* used for the Channel 1 tape allows the filter to separate periodic components of the noise from random components. Periodic components are those elements of an input signal that repeat at regular intervals — for example, the ticks of a clock and a 60-Hz powerline voltage hum.

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\*Widrow, B., Glover, J.R., Jr., McCool, J.M., Kaunitz, J., Williams, C.S., Hearn, R.H., Zeidler, J.R., Dong, E., Jr., and Goodlin, R.C., "Adaptive Noise Cancelling: Principles and Applications," *Proc. IEEE* 63, 1692-1716 (December 1975).



One property of periodic components is that, given sufficient past history, they can be predicted; indeed, a perfectly periodic signal can be predicted perfectly. The filter "learns" from the past history of the signal, estimates the signal for the next time period, and subtracts its estimate from the input. What is left are those portions of the signal that the filter cannot estimate - i.e., the random components.

A time delay was inserted into the processing system, just ahead of the adaptive filter, to assist in controlling the separation of periodic and random components. Random components having a time duration less than that of the time delay pass through essentially unaffected by the filter. These random components form the primary output of the filter. A second output was the periodic component that was being subtracted out; this subtracted information was also saved in digital form on disk. Examination of this subtracted signal, by aural and visual means, yields considerable insight into filter performance. Several test signals were fed into the filter to verify proper operation and to adjust the various filter parameters. The filter performed very well on the various test signals.

On the DPD Channel 1 tape, anticipated periodic and undesirable interferences included components of motorcycle cylinder firing, powerline hum, heterodyne "squeals," and occasional speech. Sections of this tape were played into the filter with a wide range of filter parameter values. Filter action was monitored by listening to both the primary and the secondary outputs. The filter removed residual powerline hum, some speech, and heterodyne "squeals" of time duration longer than that of the time delay. However, it

accomplished little with respect to what had been believed to be motorcycle noise. We therefore performed an autocorrelation analysis, as described below.

#### *Autocorrelation Analysis of Motorcycle Engine Noise*

Our interpretation of the sounds on the Channel 1 tape would have been made much easier if we had had some knowledge of the movements of the motorcycle carrying the microphone. For example, if we had had information on when the motorcycle was moving steadily (along a straight street), slowing down and possibly shifting gears to turn a corner, or stopping, we might have been able to infer whether these movements were consistent with travel into or through Dealy Plaza. However, we did not have this information. Thus, to determine the engine speed with greater accuracy than is possible from engine loudness, we wrote a computer program that would compute the short-time autocorrelation function of the motorcycle noise signal. This function assesses the similarity of a signal with itself shifted in time; if the signal is periodic, this similarity will peak when the signal is shifted by one period.

This autocorrelation analysis program was applied to the stuck transmission period on the Channel 1 tape. The results showed no periodicity that we could attribute to motorcycle engine firing. As a test case, this program was also applied to a high-fidelity recording of motorcycle engine noise, and it clearly showed the known periodicity of the test signal. Although our failure to detect the motorcycle engine periodicity is puzzling, it is consistent with our inability to perceive the engine firing clearly when we are listening to the tape, and it is also somewhat consistent with the failure of the adaptive noise-canceling filter to filter out a coherent motorcycle engine sound signal.

*Enhancement by Spectral Subtraction*

A third method applied to enhance the Channel 1 signals was the subtraction of a noise spectrum estimate. This method is currently under development at BBN, under U.S. Government sponsorship, for the enhancement of speech signals in the presence of stationary flat-spectrum additive noise.\* It is similar to, but somewhat more general than, the INTEL enhancement method developed by Weiss *et al.*† We could not tell whether this method would be effective with nonstationary non-flat-spectrum noise, but since the program was already available, we tried it.

In this method, the signal is converted by a Discrete Fourier Transform to a magnitude spectrum and a phase spectrum. A previously computed estimated noise spectrum is subtracted from the magnitude spectrum; the altered magnitude spectrum is then recombined with the phase spectrum converted back to a waveform by an Inverse Discrete Fourier Transform. Several parameter settings for this filtering method were used with a portion of the Channel 1 tape. None were successful in reducing the motorcycle noise without introducing noise transients attributable to the filtering process.

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\*Berouti, M., Schwartz, R., and Makhoul, J., "Enhancement of Speech Corrupted by Acoustic Noise," IEEE Int. Conf. on Acoustics, Speech, and Signal Processing, Washington, DC, April 2-4, 1979.

†Weiss, M.R., Aschkenasy, E., and Parsons, T.W., "Study and Development of the INTEL Technique for Improving Speech Intelligibility," Nicolet Scientific Corp., Report RADC-TR-75-108, 1975.

## APPENDIX B. RADIO TRANSMISSION OF GUNFIRE SIGNALS

The 1963 DPD Channel 1 radio link and recording system contained the following components: microphones, radio transmitters, an RCA Fleetline radio receiver (Model C9F350), and a Dictabelt recorder. Radio systems such as this are designed to carry speech signals and therefore incorporate signal modifiers to optimize the dynamic range and bandwidth of the system with respect to voice transmissions. Since these signal modifiers are usually incorporated in the transmitter, rather than in the receiver or the recording device, we focused our efforts to simulate the radio link on the transmitter/microphone combination.

Among the radio transmitters in use by the DPD in 1963, House Committee researchers found that five different models were used on motorcycles. These were

- Motorola Model FMT-41
- Motorola Model T-31BAT
- Motorola Model U-41GGT
- Motorola Model T-41GGT
- General Electric Model MT-13-N.

At the time of this study, it was very difficult to find manuals for these models and even more difficult to obtain access to a working unit. With the manuals we were able to find and with assistance from Motorola factory personnel, we discovered that the microphone used with the T-31BAT would have been Motorola NMN 6006A and that microphones used with the other Motorola transmitters would have had similar



characteristics; i.e., they would have been dynamic cardioid types with internal preamplifiers. We have no information about the GE radio model and its microphone. We eventually located a T-31BAT owned by the Boston Metropolitan District Commission Police Department. The MDC kindly made this radio and a GE Model ER51A receiver available to us.

The basic scheme used in this and other Motorola radio transmitter/microphone systems of the same vintage is sketched below. This type of circuit limits the slope of the audio



signal rather than its amplitude. Therefore, it will limit high-frequency signals more than low-frequency signals, as shown in Fig. 11 of this report. The frequency response of the system rolls off at 36 dB/octave above 3 kHz and at 6 dB/octave below 2.3 kHz. The signal, in effect, is differentiated and low-pass filtered. The smoothed, calculated frequency response of the system is plotted in Fig. B.1.

Our procedure for obtaining the data shown in Figs. 10 and 11 was to play tape recordings of gunfire, made anechoic by time gating, through a circuit designed to simulate the frequency response and amplitude-limiting characteristics of the Motorola 6006A microphone into a second tape recorder. We then took the second tape to the MDC Police radio shop. There, we played this tape through a variable attenuator (to control the level of the signal being put into the transmitter), through the Motorola

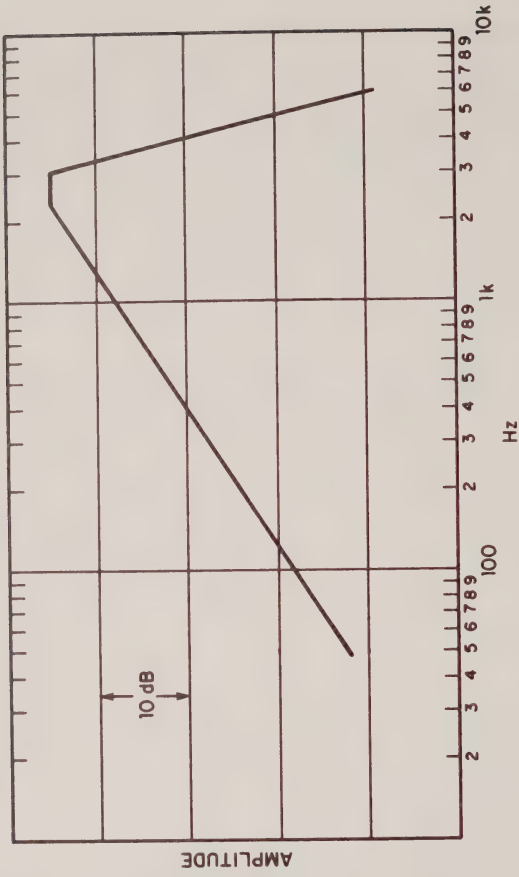


FIG. B.1. TRANSMITTER/MICROPHONE SYSTEM FREQUENCY RESPONSE.

transmitter, through the GE receiver, and onto another tape recorder. This third tape recording was played back into an oscilloscope and photographed producing the waveforms shown in Fig. 10. Peak-to-peak amplitudes of these waveforms were measured and plotted to produce Fig. 11.

In addition to having had similar effects on the waveforms recorded on Channel 1, the DPD recording shows evidence of a time constant in the 0.1 to 1.0 sec range. This AGC does not occur in any of the Motorola transmitters. It could, therefore, have been caused by the GE transmitter, by the receiver, or by the recorder.

B-4

# APPENDIX C. ANALYSIS OF FALSE ALARMS IN THE CORRELATION DETECTION TEST

The process of binary correlation that was used to detect gunfire echo patterns among the impulse patterns on the DPD tape can, like any other detector, produce false alarms. This analysis determines the number of false alarms to be expected from random noise impulses on the DPD tape.

Each echo pattern contains an average of  $M = 12$  echoes in a 1/2-sec span. But, we consider each echo to have a  $\pm 6$ -msec acceptance window to account for echo time differences introduced by not knowing the motorcycle position relative to the test microphone positions. Therefore, there are about  $N = 40$  different time slots in which the 12 echoes may exist.

Each impulse pattern contains some number of impulses ranging from  $n = 8$  to  $n = 17$ , also in a 1/2-sec span.

The matching process seeks to find the number of impulses,  $i$ , that lie within the acceptance windows of the echoes that comprise the echo pattern. If the impulses are caused by a random noise source, then the number of matches,  $i$ , is what would be expected from random sampling  $n$  times a population of  $N$  that contains  $M$  echoes. The probability of getting  $i$  matches at random is given by the hypergeometric probability distribution  $p(N, M, n, i)$ .

The correlation coefficient is defined to be equal to  $1/\sqrt{Mn}$ . The probability of obtaining a correlation coefficient equal to 0.6 or greater was calculated for  $N = 40$ ,  $M = 12$ , and  $n = 8, 10, 12, 13, 14, 17$ . The results for the six successive values of  $n$  were:  $4.8 \times 10^{-3}$ ,  $6.0 \times 10^{-3}$ ,  $8.5 \times 10^{-3}$ ,  $1.0 \times 10^{-2}$ ,  $1.2 \times 10^{-2}$ ,  $1.5 \times 10^{-2}$ .



For an impulse pattern having 10 impulses ( $n=10$ ), there are expected  $(6.0 \times 10^{-3} \times 432) = 2.6$  false alarms, because there are 432 echo patterns to correlate with. There were four impulse patterns that were correlated with all 432 echo patterns, and they had  $n = 8, 10, 12, 17$  impulses on them. The total number of false alarms to be expected works out to 13.

This number was judged to be acceptably small, so the detection threshold value was set at 0.6.

**Report No. 4034**

**Analysis of Earwitness Reports Relating to the Assassination  
of President John F. Kennedy**

D.M. Green

January 1979

**Prepared for:**  
**Select Committee on Assassinations**

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## 1. INTRODUCTION

The analysis of witness reports comprised (1) an examination of two compilations of testimony given by witnesses present in Dealey Plaza on November 22, 1963, (2) an analysis of how the sounds of gunfire in Dealey Plaza would be perceived by witnesses located at different areas in the Plaza, and (3) the reports of trained listeners who were present during the acoustical reconstruction on August 20, 1978. The two compilations examined were those by J. Thompson, in his book, *Six Seconds in Dallas*, and by members of the staff of the House Select Committee on Assassinations.

All earwitness reports, whether of those present in Dealey Plaza in 1963 or of the experienced listeners in 1978, must be examined with an understanding of the characteristic acoustical behavior of gunfire in a reverberant space. Section 2 of this report explains how listeners can misjudge the source and number of shots in such a space. Section 3 reports the analysis of the two compilations mentioned above; Sec. 4 details the observations of trained listeners stationed in the Plaza during the acoustical reconstruction.

## 2. LOCALIZATION OF SOUND

The nature of gunfire is such that three basic errors in judgment relating to the source and the number of shots are possible:

- confusion of the shock wave and the muzzle blast
- front-back reversals
- misjudgment of interfering echoes.

The acoustic stimulus, or shot, has two primary components: the shock wave and muzzle blast (illustrated in Fig. 1); and several echoes, or reflections.

### MANNLICHER-CARCANO

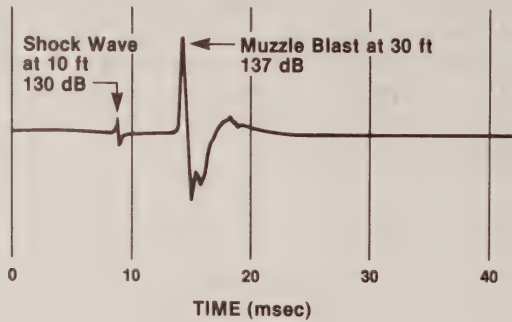
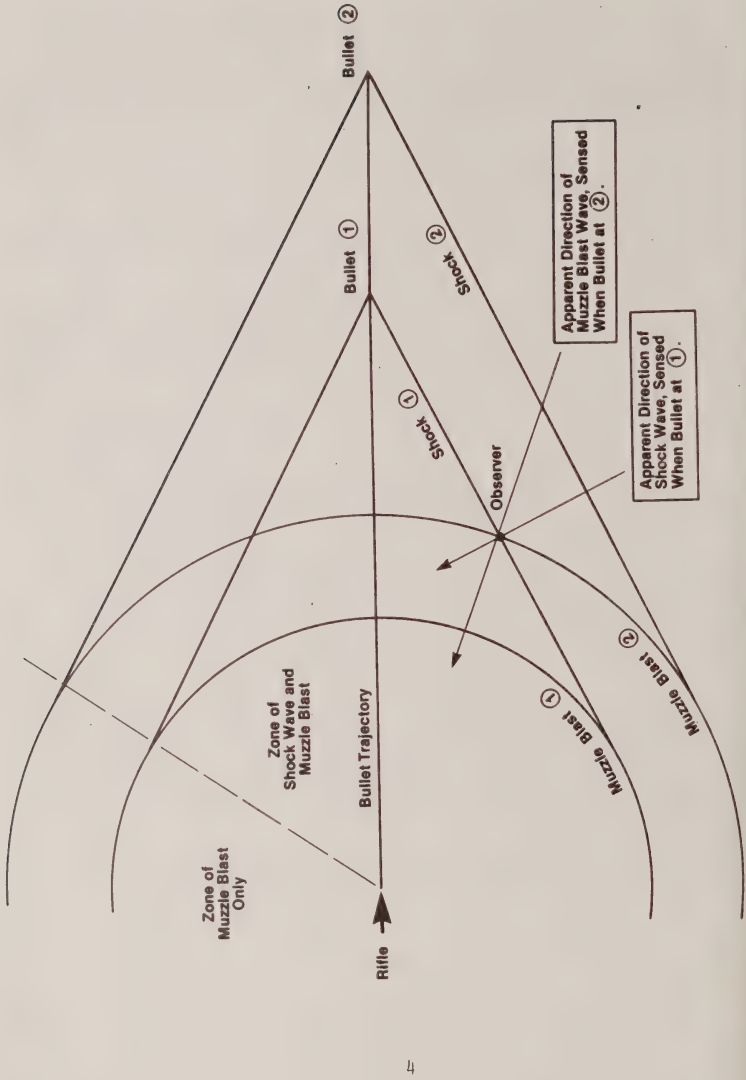


FIG. 1. MUZZLE BLAST AND SHOCK WAVEFORMS FROM MANNLICHER-CARCANO.

Because a rifle bullet travels at supersonic speed, it generates a shock wave that spreads acoustically in the shape of a cone, with the bullet as the tip of the cone. The muzzle blast, which propagates at the speed of sound, spreads out spherically from the source. Both of these sounds are very loud. The shock wave has a peak sound pressure level of about 135 dB re  $2 \times 10^{-5} \text{ N/m}^2$ , and the muzzle blast, a peak of 157 dB re  $2 \times 10^{-5} \text{ N/m}^2$ , at 1 m. The time between arrivals of these two sounds at a given listener location can vary considerably, depending on the listener's position with respect to the location of the rifle and the path of the bullet. Since the amplitude of the shock wave diminishes as one over the distance from the source and the amplitude of the muzzle blast diminishes as one over the square of the distance from the source, the relative intensity of these two sounds also varies considerably from one listener location to another.

At any reasonable distance, both the conical and spherical waves are essentially plane waves with respect to a small object such as an observer's head. Thus, to determine the *apparent* locus of the source, we need only take a perpendicular to the appropriate wavefront as it sweeps over the observer. Figure 2 shows the geometry of the two waves at two different times. The shock wave, at time 1, has just reached the observer; its apparent locus is along the path of the bullet on a perpendicular to the shock wave. At this time, the wave from the muzzle blast has not reached the observer. At time 2, when the blast wave has reached the observer, the apparent source of the shot is on a perpendicular to the plane of the spherical blast wave and, therefore, at the muzzle of the rifle.





Dr. George Garinther confirmed this analysis at a test carried out with 20 to 30 observers at the Aberdeen Proving Ground. The observers were seated in rows parallel to the path of the bullet. The blast wave was muffled by firing the rifle through a small hole in an enclosed van. The reports of the observers are portrayed graphically in Fig. 3. About 75% of the observers pointed at the path of the bullet, while 25% pointed away from this path — but still perpendicular to the surface of the conical shock wave.

This latter judgment is called a front-back reversal. If the sound of the shock wave were not so brief, an observer would have time to execute a head motion and tell whether the source was exactly in front of or behind him. However, the shock wave endures for only about 1 msec and the blast wave about 5 msec; some front-back reversals are therefore expected. Even if the muzzle blast is not silenced, the observer may be confused. The further the observer stands away from the muzzle and the nearer the path of the bullet, the more likely that localization of sound will be based on the shock wave and, hence, incorrect.

Some muffling of the blast wave will occur if a rifle is fired from within an open window. Thus, in the acoustical reconstruction, the rifle was fired from two locations in the TSBD: (1) in the plane of the open sixth-floor window and (2) with the muzzle tip withdrawn 2 ft from the plane of the window.

The buildings around the Plaza caused strong reverberations, or echoes, that followed the initial sound by from 0.5 to 1.5 sec. While these reflections caused no confusion to our listeners, who were prepared and expected to hear them, they may well have

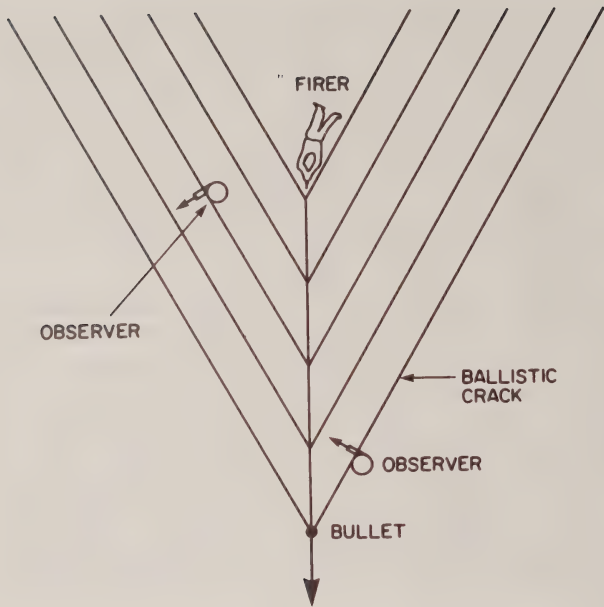


FIG. 3. OBSERVERS LOCALIZING SOURCE OF SOUND ALONG PATH OF BULLET.

inflated the number of shots reported by the surprised witnesses during the assassination. The source of these echoes can be predicted from the general geometry of the Plaza. For example, one hears a very strong reflection from the Post Office Annex that arrives about 1 sec after the shot, regardless of whether the rifle is fired from the TSBD or the knoll. Because of the long delay, a listener located on the knoll would recognize this as an echo but might place the source somewhere in back of him, anywhere from the TSBD to the railway overpass.

From near the TSBD, a listener would hear a strong echo from the general vicinity of the railway overpass. However, since the initial disturbance, the shock wave from the bullet, would be almost directly overhead - an anomalous locus, especially if the rifle had been fired from well within the TSBD - this echo would cause some confusion. The general area of the knoll, to the right of the bridge, would then be a prime candidate as the locus of the source. Even though this echo occurs 0.8 sec after the shock wave, it is the first sound that would make sense to the listener. On the other hand, listeners located near the railroad overpass would react to the very strong reflections from along Houston St.

For listeners in the Plaza area, the location of the rifle muzzle relative to the window opening is a critical determiner of the perceived sound. The further inside the building the muzzle is located, the greater the potential for the shock wave to dominate perception. If the muzzle of the rifle had been withdrawn and, therefore, little or no blast were present for one or more of the shots in 1963, the localization judgments of people in the Plaza would have been based primarily on the shock wave, creating much uncertainty and lack of agreement.

During the reconstruction, echoes were heard from the new hotel, but they arrived some seconds after the primary sound and long after the earlier echoes from structures bordering the Plaza. The hotel echoes, therefore, did not interfere with the subjective evaluations in any way.



### 3. STATISTICAL SURVEYS

#### 3.1 Origin of Shots

According to Investigator J. Basteri, 692 people were present in the Plaza during the assassination. Two surveys of interviews and testimony given by some of these people have classified the witness reports as to the origin of gunfire into four categories: the TSBD, the Knoll, Other (not TSBD or Knoll), and Don't Know (origin uncertain). J. Thompson's compilation in *Six Seconds in Dallas* of 190 witness reports is summarized in Table I.

TABLE I. THOMPSON'S ANALYSIS OF ORIGIN OF SHOTS.

TSBD	Knoll	Other	Don't Know	Total
25	33	6	126	190
13.2%	17.3%	3.2%	66.3%	100%

This sample of 190 is 27.4% of the total available witnesses. It is difficult to know what, if any, bias is present in the selection of these witnesses. The sheer size of the sample makes it difficult to believe that a sizeable selection bias was present. It is also difficult to predict the effect of a selection bias, if one were present. How could one tell what the witness was likely to report prior to the interview? People were scattered over a large area of the Plaza, but we do not know if equal proportions were selected from each area. This factor could influence the results, since analyses reveal that a person located near the knoll was more likely to report the knoll as the origin of the shots than any other location; similarly, a person located near the TSBD was more likely to report the TSBD as the origin of the shots than any other location.

The House Committee compilation is drawn from witness interviews by the Dallas Police Department and the FBI and from sworn testimony in the Warren Report. The total number of reports in this survey is 178. With very few exceptions, all these people appeared in the 190 sampled by Thompson. Similar sample-selection uncertainties apply here as well. The House Committee analysis is summarized in Table II.

TABLE II. HOUSE COMMITTEE ANALYSIS OF ORIGIN OF SHOTS.

TSBD	Knoll	Other	Don't Know	Total
49	21	30	78	178
27.5%	11.8%	16.9%	43.8%	100%

Over half the sample had some opinion as to the origin of the shot; the majority of these reported the origin as the TSBD. Twenty-one witnesses reported the Knoll as the source, 30 reported some other location, and only 4 witnesses gave more than a single location for the shots. The four reporting a dual or multiple location are counted as "Other" in Table II. Of the 49 witnesses pointing at TSBD, 13 were at the depository itself, 16 were in the motorcade, and the remainder were scattered throughout the area, including at the Sheriff's Office, the overpass, the knoll, and the triangular park.

A breakdown of these reporting the knoll as the origin of the shots show that 2 of 21 were located on the knoll. Eight were on the curb along Elm St. on the knoll side or on that side of the motorcade traveling down Elm St. Four were near the TSBD. One was on the east side of Houston. Five were in

the triangular area bordered by Elm, Houston, and Main, and one was on the railroad overpass.

An analysis of the "Other" responses showed no obvious pattern. Some witnesses at the TSBD point toward Houston St.; others point down Elm. Similarly, those at the Sheriff's Office point in an arc ranging from west of TSBD to the railroad overpass.

Comparing this statistical analysis with Thompson's, the most striking discrepancy is the relatively low percentage of witnesses reporting origins other than the knoll or the TSBD in Thompson's compilation. Another important difference is in the relative number of people pointing at the TSBD vs the knoll. Although the categorization of a given response is somewhat arbitrary, the major discrepancy in the two compilations must be laid to a difference in classification of responses making up the compilations. Zapruder is listed in the Thompson survey as pointing to the knoll, while his sworn testimony before the Warren Commission was as follows:\*

Liebelser: But you didn't form any opinion at that time as to what direction the shots did come from actually?

Zapruder: No.

Hence, House Committee staff placed his response in the "Don't Know" category.

### 3.2 Number of Shots

The House Committee compilation also categorized witness responses according to number of shots attributed to the four

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\*Warren Report, Vol. 7, p. 572.

different categories of origin. This analysis is summarized in Table III.

TABLE III. NUMBER OF PEOPLE REPORTING VARIOUS ORIGINS AS A FUNCTION OF THE NUMBER OF SHOTS REPORTED

Reported Origin of Shot	No. of Shots Reported					Total
	2	2 or 3	3	4	Don't Know	
TSBD	3 (4.5)*	2 (1.9)	38 (35.5)	2 (1.6)	1 (2.4)	46
Knoll	5 (2.0)	2 (0.8)	11 (15.4)	0 (0.7)	2 (1.1)	20
Other	2 (2.9)	1 (1.2)	22 (22)	3 (1.0)	1 (1.5)	29
Don't Know	7 (7.5)	2 (3.1)	61 (58.6)	1 (2.7)	5 (4.0)	76
Total	17	7	132	6	9	171 <sup>†</sup>

\*Expected number of judgments if origin and number of shots are independent judgments.

<sup>†</sup>Seven other witnesses report 1, 4-5, 5, 6, or 8 shots.

Reports as to the number of shots range from 1 to 8. Of the 178 witnesses, however, the vast majority, 74.2% (132/178), reported 3 shots, and the mean number reported was 2.98.

Given the scatter in the reported sources of the gunfire, one tenable hypothesis is that only people in certain locations might hear the knoll shot. We therefore sought to investigate to what extent the data matrix was interrelated, i.e., to what extent does one judgment influence the other? One test for



this interrelation is to assume the converse — namely, that the judgments are independent and to determine how well we can predict the entire data matrix on the basis of this hypothesis. The expected number, which is given in parenthesis beneath the number of people actually reporting, is calculated by determining the probability of each report from the margins and assuming that a particular cell, the intersection of that row and column, can be calculated from the product of the probabilities. For example,  $20/171 = .117$  report the shot coming from the knoll and  $132/171 = .772$  reported 3 shots. Thus, the joint occurrence of both events, assuming they are independent, is  $(.772)(.117) = .09$ , and the expected number of such reports is  $(.09)(171) = 15.4$ . The number of people reporting shots in this cell of the matrix is 11, 4 or 5 fewer than expected. By and large, the predictions are excellent, and there is no reason to suspect that the two responses are other than independent.

#### 4. REPORTS OF TRAINED OBSERVERS

On August 20, 1978, Dr. Dennis McFadden of the Psychology Department of the University of Texas and Dr. Frederick Wightman of the Department of Audiology at Northwestern University listened to the three sequences of shots fired during the acoustical reconstruction and recorded their impressions. Appendix A contains a transcription of their notes. Their reports concerned the apparent origin of shots, any apparent secondary sources or echoes, how loud the shots were, and any other remarks they felt appropriate.

Initially, we were uncertain as to how easy it would be to determine the correct location and what degree of consistency there would be among the observers. Hence, for the first sequence, and during most of the second, the observers were located about 1 m apart and in such a way that I could see and compare their responses. The approximate observer locations for each sequence are indicated in Fig. 4. During the first sequence, Dr. Wightman correctly localized all 17 shots, and Dr. McFadden missed only 1. Their general qualitative descriptions and descriptions of the reverberations were also highly consistent. We were, therefore, more confident about the consistency of the reports, and during the latter part of the second sequence, Dr. McFadden moved from his original location at the curb at the top of Elm directly in front of the TSBD, to across Elm on the southwest corner of Elm and Houston. For the third sequence, Dr. Wightman and I observed from the grassy triangle formed by Elm, Houston, and Main Sts., while Dr. McFadden observed from the railroad tracks, above the northern curb of Elm.

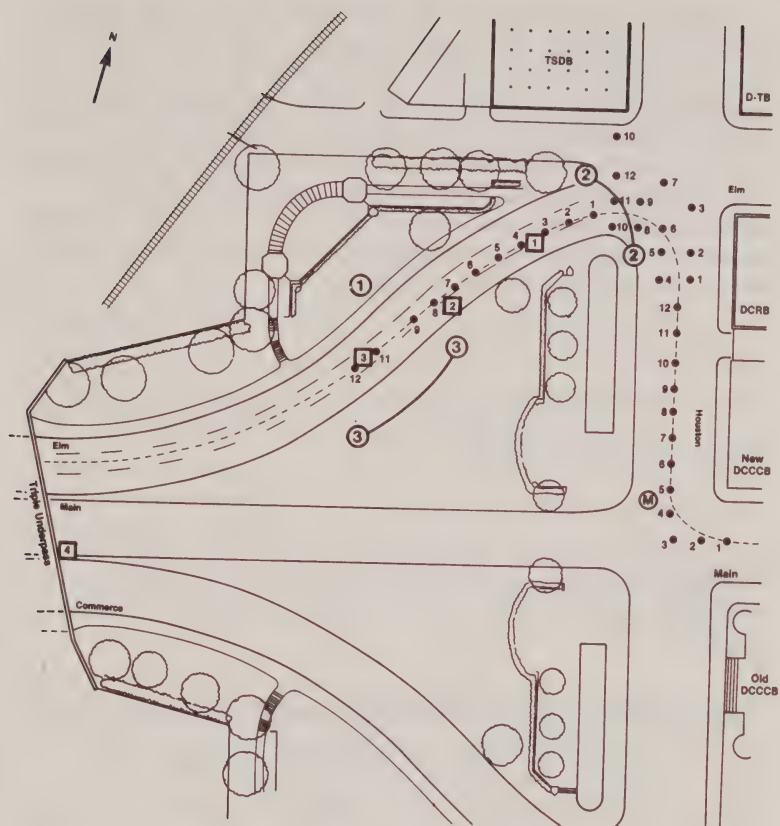


FIG. 4. OBSERVER LOCATIONS AT DEALEY PLAZA.

My own impressions and the reports of Dr. William Hartmann, the investigator of the "jiggle analysis," were very similar to those of McFadden and Wightman; although my own hearing is impaired by about 50 dB in my left ear. The primary manifestation of this difficulty was my failure to hear some echoes if they occurred to my left. Thus, it would seem that our observers, because of their special training and experience, are only slightly more acute concerning nuances of the echoes and reverberations and, perhaps, in separating the shock wave and the blast wave than are untrained people.

The emotional condition of our observers during the test and the emotional condition of the people during the assassination were undoubtedly quite different. The influence of such emotion on the localization judgment may be quite large, but there is no way to quantify this factor.

#### 4.1 Test Conditions

The shot sequence was unknown to both of the observers. Because repeats of certain shots were requested during the sequence, I was also uncertain — despite knowing the planned sequence.

We requested three motorcycles to be running during the test to provide some background noise that would approximate the original listening conditions in Dealey Plaza. Unfortunately, these newer motorcycles were not very noisy, but the shots were so loud that any reasonable level of background noise would have been low in comparison with the shots themselves. Our listening conditions were, therefore, essentially representative of those at the time of the assassination, except for our being able to hear some very-low-level, long-delay echoes that originally might have been inaudible.



Our observers *did* know that there were only two possible locations for the marksman, whereas there was considerably more uncertainty on this issue at the time of the assassination. Signal uncertainty of this kind generally does not seriously degrade the accuracy of judgments, but it does depend on the number of potential alternatives. In this case, as we shall see, the localization reports made by the trained listeners were, for the most part, of general areas, rather than specific windows of a building. The total number of potential locations was not, therefore, large and, thus, was likely to be representative of localization responses given at the time of the assassination.

#### 4.2 Analysis of Observers' Localization Responses

The descriptive comments made by the observers are difficult to compare with any degree of precision. However, there was clear agreement in their reports with respect to the apparent loudness of the sounds and echoes and the apparent size of the acoustic image. After each test shot, we asked the two observers to guess whether the shot was fired from the TSBD or the knoll, independent of what the apparent locus might be. Table IV is an analysis of this forced-choice data.

TABLE IV. ACCURACY OF FORCED-CHOICE RESPONSES AS TO ORIGIN (TSBD OR KNOLL)

Sequence	Dr. Wightman		Dr. McFadden	
1	12/12	100%	11/12	92%
2	11/15	73%	14/15	93%
3	19/25	76%	23/25	92%
Overall	47/57	82%	53/57	93%

Overall Agreement 82%

The average accuracy of the reports is nearly 90%, and the consistency between the two observers is 82%. Also, the average accuracy is nearly exactly the same whether the shot came from the TSBD or the knoll. Thus, this analysis shows high accuracy in localizing the source of the sound and reasonably good consistency.

#### 4.3 Loudness and Apparent Size of Acoustic Image

All observers rated the rifle shots as very very loud, and they were unable to understand how they could have been described as a firecracker or backfire. Only the pistol, which was subsonic, produced a moderate loudness.

Practically all the rifle shots, whether fired from the knoll or the TSBD, appeared to be diffuse and to occupy a very large acoustic space. For example, the sound did not seem to come from the sixth floor window of the TSBD, but from the right upper side of the building. This apparently large source location may be a result of acoustic scatter of the muzzle blast - either because of the building in the case of the TSBD or because of the trees in the case of the knoll. Only the pistol shot appears to have a reasonably constrained acoustic image and, for that reason, could be localized with some precision.

One might consider whether silencers would change the apparent loudness or the size of the image. The Garinther-Moreland study\* reports the average attenuation produced by a number of silencers as being about 18 dB for all weapon-silencer combinations. Sound from the supersonic weapons tested were attenuated

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\*"Acoustical Considerations for a Silent Weapon System: A Feasibility Study," 1966, p. 70.

by 18.6 dB and 37.5 dB, but even with this reduction, the peak overpressure was still very large. Two rifle-silencer combinations produced peak overpressures of 138 dB and 120 dB at 3.8 m, clearly loud enough to be easy to locate and clearly audible above the motorcycle and crowd noise.

## 5. CONCLUSIONS

It is difficult to draw any firm conclusions relating the reports of witnesses in the Plaza to the possible locus of any assassin. Confusion between the shock wave and muzzle blast, front-back reversals, confusion caused by echoes, and the startle of the witness could all be used to impeach the testimony of any particular witness. There is no way of knowing which, if any, of these factors was most significant with respect to any single observation made on November 22, 1963. Thus, one witness can be assigned no more credibility than any other. For example, even if a shot was fired from the TSBD, the witnesses standing on the knoll would likely report the source of the shot in the following way. The witness would presumably localize on the basis of the shock wave. With the path of the bullet behind the President's car, the witness would perceive the apparent locus of the shot as being on a line from himself to the bullet's path - i.e., in the street or open park behind the path of the bullet. Since this location is impossible, a front-back reversal is likely. This front-back reversal would place the source 180° behind the bullet path and, hence, on the knoll.

Despite this uncertainty, two general remarks seem worthwhile - one based on the test, the other on the statistical analysis.

First, it is hard to believe a rifle was fired from the knoll. Such a shot would be extremely loud, even if silenced, and it would be hard to imagine anyone in the vicinity of the knoll missing such an event. An unsilenced pistol firing subsonic bullets also seems unlikely because this shot was the easiest to localize of all the shots fired. It produced the least reverberation. As an acoustic image, it was much sharper



and less diffuse than that of the rifle, sounding much like a firecracker. It is, however, conceivable that had a pistol been fired from the knoll at about the same time a rifle was fired from the TSBD, the pistol shot would have been less easily localized, or even completely masked from some vantage points. As an isolated shot, however, it is extremely easy to localize.

Finally, if one accepts the hypothesis that a marksman fired from the knoll and that other shots were fired from some other location, then it seems most unlikely that only 4 of 178 witnesses would report a single location as the origin of the shots. Despite the various causes of confusion in the locus of any single shot, a second shot from a different location should be distinctive and different enough to cause more than four witnesses to report multiple origins for the shots.

## APPENDIX A. TRANSCRIPTION OF OBSERVERS' NOTES

The tabular information in this appendix was transcribed from notes made during the acoustical reconstruction on August 20, 1978 by two trained observers - Dennis McFadden and Frederick Wightman. Included in this table, along with their responses, are the number of the shot in each sequence of test firing, the origin of the shot, and the target fired upon. For convenience in determining the positions of rifle, target, and listener, the reader may refer to Fig. 4 of this report.

Abbreviations used within the table are as follows:

- T always refers to the TSBD and K to the knoll.
- In the column headed origin,  $T_p$  means the rifle was fired in the plane of the sixth floor window of the TSBD,  $T_2$  means the muzzle was withdrawn 2 ft from the plane of the window, K indicates a rifle shot from the knoll, and  $K_p$  represents a pistol shot from the knoll.

A.1 Observer: Dennis McFadden

Location 1: On grass north of Elm Street in front of Zaprunder position

Shot No.	Origin	Target	Forced Choice Response	Judgments	Blast and N-Wave	Comments
1	T <sub>p</sub>	1	T	TSBD Something behind me, too. Long reverberation from south.	?	--
2	T <sub>p</sub>	1	T	TSBD Long reverberation from south.	?	Different quality than No. 1-- Less reverberation?
3	T <sub>p</sub>	1	T	TSBD	Yes, sharp crack.	Heard a sharp crack but also muzzle. Acoustically rich?
4	T <sub>p</sub>	1	T	TSBD	Duller thud than No. 3. (Muzzle?)	Long reverberation from south. Somehow not so rich as No. 3.
5	T <sub>p</sub>	1	T	TSBD	Somewhat sharper than No. 4. No obvious crack.	Very rich acoustically. Maybe as many as 4 to 5 echoes, 2 to 3 of them earlier and weaker than strong 1 from south. All reverberations from south.
6	T <sub>2</sub>	1	T	TSBD	No crack.	Very much like No. 5.
7	T <sub>p</sub>	2	T	TSBD	Yes, blast and crack.	Perhaps not so much reverberation from south.

A-2

## A.1. (Cont.)

Shot No.	Origin	Target	Forced Choice Response	Judgments	Blast and N-Wave	Comments
8	T <sub>2</sub>	2	T	TSBD	Yes, blast and crack.	Very much like No. 7.
9	K	2	K	Over my head. Not really on Knoll or even behind me.	No, not a sharp crack, blast and N-wave blended.	One massive experience. No clear reverberation from south.
10	T <sub>p</sub>	3	T	TSBD	Yes. Crack.	Long reverberations from south.
[TSBD as a response means only "to the left"; impossible to localize at sixth floor window; diffuse origin.]						
11	T <sub>2</sub>	3	K	Multiple locations. Overhead kind of toward court house on Houston.	Yes. Crack primarily.	Single sharp sound initially plus reverberation. Most firecrackery sound so far.
12	K	3	K	To the right on the Knoll with absolutely no question.	No crack.	Made me jump. Very loud compact sound. No obvious reverberations.
13	K <sub>p</sub>	3	K	To the right on Knoll.	No. Pistol, I guess.	Kind of firecrackery but a little too long. Much less loud. No obvious reverberations. Localization judgments are probably being affected by knowledge of source. Also an experience of it being high in air over toward blue hotel.



## A.1 (Cont.)

Shot No.	Origin	Target	Forced Choice Response	Judgments	Blast and N-Wave	Comments
14	K <sub>p</sub>	3	K	To the right Knoll/underpass	No.	Just like No. 13. Single compact, high-frequency sound. No obvious reverberations.
[These last two pistol shots from Knoll sounded to our right, but not so obviously from behind as did No. 13; No. 13 and No. 14 were more like from overpass.]						
15	T <sub>p</sub>	4	T	TSBD (No motorcycle on for No. 15.)	Yes, I think so. Certainly was a sharp report.	Very sharp report. Minimal reverberation. Just a couple of echoes.
16	T <sub>2</sub>	4	T	TSBD Sound definitely began at TSBD.	Definitely yes. Muzzle followed by very sharp crack.	Pretty good reverberation. 3 to 4 good echoes.
17	K	4	K	On Knoll pretty far behind me. Pistol?	Uncertain. Maybe just N?	Big "pop." Sounded like large pistol rather than rifle. Not clear about reverberation. Think there was an echo located over by truck.

[Truck was then on NW corner of Main and Houston, pointed west on Main.]

## A.1 (Cont.)

Location 2: On sidewalk on north side of Elm, across east-west side street (also Elm?)  
from TSDB

Shot No.	Origin	Target	Forced Choice Response	Judgments	Blast and N-Wave	Comments
1	T <sub>p</sub>	1	T	Directly overhead.	No. Just one massive and diffuse sound.	One big shock. Couple of very weak reverberations following it. Long delay. Totally different from Location 1.
2	T <sub>2</sub>	1	T	Overhead — not directly though.	--	Sharper than No. 1. Localized kind of down front of TSDB because I had my head turned down Elm talking.
[This is the east-west Elm in front of TSDB.]						
3	T <sub>2</sub>	1	T	Overhead	No.	Somewhere between No. 1 and No. 2 in sharpness.
4	T <sub>p</sub>	2	T	Overhead and to some degree on overpass. Right down the street (Elm).	No, one big sound.	Stronger and longer delay reverberations than previous couple of shots.
5	T <sub>2</sub>	2	T	Overhead	No, one sound.	Very much the same as No. 4.
6	K	2	K	Knoll area Pistol?	Pretty much a crack. Not a firecracker though.	3 to 4 good echoes from behind me. From TSDB.

A.1 (Cont.)

Shot No.	Origin	Target	Forced Choice Response	Judgments	Blast and N-Wave	Comments
7	T <sub>p</sub>	3	T	Overhead	No, single sound.	Besides echoes from blue hotel area, got a good one from my left (down Houston St.) that wasn't delayed very long.
8	T <sub>2</sub>	3	K	Hard to tell. Knoll area but more to <i>right</i> of it. In gazebo thing.	--	--
9	K	3	K	Definitely Knoll. Pistol?	Compact thud.	Little reverberation if any.
10	K <sub>p</sub>	3	K	Knoll Pistol?	Brief "pop." Weakest source so far.	Firecrackery except a little too long and a little too low frequency.
11	K <sub>p</sub>	3	K	Knoll Pistol again. Re-do of 10.	Pop gun! Same as 10 except ... (didn't finish this)	We had crossed street and gone to stand in front of truck over by court house for this trial only.
12	T <sub>p</sub>	4	T	Down Elm. Also along front sur-face of TSEBD (to our right rear).	? No. All pretty much 1 sound.	Loud, dense sound. Some rapid reverberation.

A-6

## A.1 (Cont.)

Shot No.	Origin	Target	Forced Choice Response	Judgments	Blast and N-Wave	Comments
13	T <sub>2</sub>	4	T	--	Muzzle and very sharp crack.	Crack seemed high in air and down along front surface of TSED (to our right rear).
<p>For the next two shots I was across the street, crouched down near "The Brennan Position" with Bill Hartman. He had indicated that he heard a clear "double sound" from that location on previous shots, and D.M. Green sent me there to check on Hartman's report. My experience was much in accord with Hartman's; and from that spot the muzzle blast was muted somewhat, the rich reverberations so obvious from Location 2 were generally absent, and there was a clear "double-thud" and/or "triple-thud" quality to the shot.</p>						
14	K	4	K	"Brennan Position"	--	Muzzle from Knoll area and then marked second and third report from northeast.
15	K	4	K	Knoll "Brennan Position"	No	2 marked fronts. Muzzle and then echo from Mel Rose Bldg.

[Exact head location clearly very important back behind this wall, for in No. 14 I heard more than one echo (less than about 750 msec) and in No. 15 I heard only one. In between, I had moved my body and head.]



## A.1 (Cont.)

Location 3: On underpass over the most southerly lane of Elm.

Shot No.	Origin	Target	Forced Choice Response	Judgments	Blast and N-Wave	Comments
1	T <sub>p</sub>	1	T	Definitely TSBD area, <i>not</i> Knoll. To right slightly of TSBD; from juncture of 3 buildings at corner of Elm and Houston.	No, single blast.	Got a rapid echo off court house (on corner of Houston and Main).
2	T <sub>p</sub>	1	T	Definitely TSBD area.	No, single blast.	A little more diffuse in locus than No. 1.
<p>From this location for the first two targets I frequently heard numerous, reasonably strong echoes off the fronts of the buildings lining Houston St. (Records Bldg. and Court House). Often there was an impression of them running off in rapid sequence from north to south. Not so for target on Main St. See below.</p>						
3	T <sub>2</sub>	1	T	Definitely TSBD area.	No crack.	Some good echoes. 3 to 4 from Houston St. bldgs.
4	T <sub>p</sub>	2	T	Definitely TSBD.	--	Much louder than previous shots. More echoes too. 5 to 6 all within 1 second or so. Also got some echo from behind (blue hotel) but it wasn't here then (in 1963).

## A.1 (Cont.)

Shot No.	Origin	Target	Forced Choice Response	Judgments	Blast and N-Wave	Comments
5	T <sub>2</sub>	2	T	TSBD	Yes. Crack and muzzle	Much more of a crack. Many echoes from Houston St. bldgs.
6	K	2	K	More toward Knoll but not markedly so.	Quieter than previous.	Not like it was way to my left.
<p>[This last comment was meant to indicate my uncertainty as to the origin of the shots heard from this location. I <i>knew</i> some were supposed to be from Knoll and some from TSBD, but none seemed to be coming from Knoll. No. 6 seemed to be different in its origin from previous ones, but it didn't really localize at the Knoll, just more to the left, more towards the Knoll, than the previous shots. The feeling of uncertainty persisted.]</p>						
7	T <sub>p</sub>	3	T	TSBD	Some crack. Not so loud as some previous TSBD shots.	Plenty of reverberation.
8	T <sub>2</sub>	3	T	TSBD? Not clear. Kind of between Knoll and TSBD.	Some crack.	Reverberation weak.
9	K	3	K	Knoll? Not really confident.	More blast than ____.	Coming too fast to get thoughts straight and reactions written.

Shot No.	Origin	Target	Forced Choice Response	Judgments	Blast and N-Wave	Comments
10	K <sub>p</sub>	3	K	Knoll definitely. Pistol?	Weak sound.	Little reverberations. I think the uncertainty about Knoll localization with rifle shots may be (due to a) short, strong reflection off TSBD bldg. directly behind it (Knoll). This one, if it was a pistol was much more compact and easily localized.
11	T <sub>p</sub>	1	T	TSBD definitely.	Compact sound.	Acoustically rich. Most marked echoes from behind me off blue hotel.
12	T <sub>2</sub>	1	T	Again, definitely TSBD corner.	Compact sound.	Early echoes not really strong, but present. Stuff comes (off of) front of Houston St. bldgs.
13	T <sub>p</sub>	2	T	Same as No. 12? Pretty small focus of localization.	--	Very much like No. 12.
14	T <sub>2</sub>	2	T	Same as 13? Small focus. Right at corner Elm and Houston.	--	--
15	K	2	T	TSBD	--	Much sharper early echoes off Houston St. bldgs.

## A.1 (Cont.)

Shot No.	Origin	Target	Forced Choice Response	Judgments	Blast and N-Wave	Comments
16	T <sub>p</sub>	3	T	TSBD? Maybe Knoll.	Compact sound not as loud as some.	--
17	T <sub>2</sub>	3	T	Same as No. 16.	Same as No. 16.	Most marked echoes from ... (see below)
18	K	3	K	Knoll?	Compact.	Good echo off post office. Not so obvious off Houston St. bldgs.
No. 16, No. 17, No. 18, all came fast and my writing lagged behind them.						
<div style="border: 1px solid black; padding: 5px;"> <p>Remainder of shots taken at target on south curb of Main St. which was to my right (south). With exception of No. 19 (during which I was writing and my head was averted) all of these shots aroused very distinct impressions of a source due east, directly down Main St. I was clearly using only the N-wave and ignoring the blast.</p> </div>						
19	T <sub>p</sub>	4	T	TSBD? (Had head down and averted at time of this shot.)	Good crack. Some muzzle too.	Echo off post office.
20	T <sub>p</sub>	4	T	Localized on N-wave right down Main St.	Good crack. No muzzle.	--
21	T <sub>2</sub>	4	T	Same as 20.	Louder somehow?	--
22	K	4	T	Same as 20 and 21.	Very good crack.	--



## A.1 (Cont.)

Shot No.	Origin	Target	Forced Choice Response	Judgments	Blast and N-Wave	Comments
23	T <sub>p</sub>	4	T	Same as above.	--	Some reverberation off post office and blue hotel.
24	T <sub>2</sub>	4	T	Right down N-wave. Right down Main St.	Good crack.	--
25	K	4	K	More to left toward TSBD and/or Knoll but not really at it. More from court bldg.	Very full sound (long and low-frequency I guess I mean).	--

## A.2 Observer: Fred Wightman

Location 1: On grass north of Elm Street in front of Zapruder position

Shot No.	Origin	Target	Forced Choice Response	Apparent Source Description	Secondary Choice	Reverberations	Loudness
1	T <sub>p</sub>	1	T	TSBD	across st. (3) PO	3 or 4	High
2	T <sub>p</sub>	1	T	TSBD	across st. (3) PO	3 or 4	High
3	T <sub>p</sub>	1	T	L of TSBD	across st. PO	3 or 4	High
4	T <sub>p</sub>	1	T	TSBD	PO	3 or 4	High
5	T <sub>p</sub>	1	T	TSBD	PO	3 and 4	Sharper than 1 to 4 sharp echoes 3 or 4, then big echo, echoes from concrete st. in plaza.
6	T <sub>2</sub>	1	T	TSBD	PO	3 or 4	About like 5, but duller.
7	T <sub>p</sub>	2	T	TSBD	PO	Crack at beginning	Sharp.
8	T <sub>2</sub>	2	T	TSBD	--	--	Same as 3.
9	K	2	K	Knoll - to right (of FW)	--	--	--

Shot No.	Origin	Target	Response	Apparent Source Description	Secondary Choice	Reverberations	Loudness
10	T <sub>p</sub>	3	T	TSBD	--	Sharp crack at beginning.	A little duller than 7.
11	T <sub>2</sub>	3	T	TSBD	PO	--	Sharpest, smallest.
12	K <sub>p</sub>	3	K	Knoll to right (of FW).	None.	--	Loud, dull, large sound.
13	K <sub>p</sub>	3	K	Knoll	None.	Little.	Cracker-like, thin, little reverb, though crackly.
14	K <sub>p</sub>	3	K	Knoll - underpass from south of Knoll.	--	Little.	Firecracker-like.
15	T <sub>p</sub>	4	T	TSBD	2 - PO plus new hotel.	--	Crack.
16	T	4	T	TSBD	In front - the reverbs only.	--	Dull, hollow, big.
17	K	4	K	Knoll	Was looking in Knoll direction.	--	Loud, dull, large sound.

## A.2 (Cont.)

Location 2: On sidewalk on north side of Elm, across east-west side street (also Elm?)  
from TSBD

Shot No.	Origin	Target	Forced Choice Response	Apparent Source Description	Secondary Choice	Reverberations	Loudness
1	T <sub>p</sub>	1	T	TSBD (above and behind)	No reverb to speak of.	--	Big blast, no crackling shock wave felt.
2	T <sub>2</sub>	1	T	TSBD and in front	--	--	Less blast, strong echoes from in front.
3	T <sub>2</sub>	1	K	Knoll and TSBD (equal)	--	--	Blast -- very diffuse.
4	T <sub>p</sub>	2	K	Knoll	--	--	Strong, higher pitched blast
5	T <sub>2</sub>	2	T	Overhead -- toward Knoll.	--	--	--
6	K	2	K	Knoll	2 shots clearly separate	--	Little blast origin of 2nd, not clear, small sources.
7	T <sub>p</sub>	3	K	Knoll and	2 echoes 1 above -- one in front left.	--	Big blast.
8	T <sub>2</sub>	3	T	Above and right (not clearly TSBD but not as clearly Knoll as 4 and 6).	--	--	Blast



Shot No.	Origin	Target	Forced Choice Response	Apparent Source Description	Secondary Choice	Reverberations	Loudness
9	K	3	K	Single dull blast from Knoll - no confusion.	No reverb at all - quite a thud.	--	Dull blast.
10	K <sub>p</sub>	3	K	Knoll, almost behind arc-like structure Firecracker-like "smallest" source of all.	--	--	--
11	K <sub>p</sub>	3	K	Knoll to left of arc-like structure no question - precise localization. Firecracker-like small source.	--	--	--
12	T <sub>p</sub>	4	T	Above and toward Knoll. Reverb from new hotel strong blast or shock wave.	--	--	--
13	T <sub>2</sub>	4	K	Knoll, above several reverb, sharp blast - higher pitch. 1 strong "twig-snap" after 300 msec.	--	--	--

## A.2 (Cont.)

Shot No.	Origin	Target	Forced Choice	Apparent Source Description	Secondary Choice	Reverberations	Loudness
14	K	4	K	Knoll, lots of reverb dull blast	--	--	--
15	K	4	K	Knoll about like 13, sharper blast			
<i>Location 3: On underpass over the most southerly lane of Elm.</i>							
1	T <sub>p</sub>	1	T	TSBD 6th floor	--	--	Prom. blast
2	T <sub>p</sub>	1	T	TSBD	--	--	Hotel echo after long delay.
3	T <sub>2</sub>	1	T	TSBD	--	--	Hotel echo after long delay. Sharper - less blast.
4	T <sub>p</sub>	2	T	TSBD - all reverb to left.	--	--	Hotel echo (as in 2,3).
5	T <sub>2</sub>	2	T	TSBD	--	--	Single, thinner blast, smaller.
6	K	2	T	TSBD (or in front).	--	--	Crack before blast.
7	T <sub>p</sub>	--	T	TSBD diffuse.	--	--	Blasting.
8	T <sub>2</sub>	3	T	TSBD	--	--	Cracker.

Shot No.	Origin	Target	Forced Choice Response	Apparent Source Description	Secondary Choice	Reverberations	Loudness
9	K	3	K	Knoll - big blast - booming, broad image where shooter was.	--	--	--
10	K <sub>p</sub>	3	K	Knoll - small source precise location firecracker.	--	--	--
11	T <sub>p</sub>	1	T	TSBD	--	--	Like 6.
12	T <sub>2</sub>	1	T	TSBD	--	--	More cracking than 10
13	T <sub>p</sub>	2	T	TSBD	--	--	Big blast - lots of reverb for 2 sec.
14	T <sub>2</sub>	2	T	TSBD	--	--	Reverb in front, little cracks.
15	K	2	T	TSBD or in front.	--	--	Big blast - diffuse.
16	T <sub>p</sub>	3	T	TSBD, more definite.	--	--	Hollow blast, more local to 6th floor.
17	T <sub>2</sub>	3	T	TSBD	--	--	Sharp

A-18

## A.2 (Cont.)

Shot No.	Origin	Target	Forced Choice Response	Apparent Source Description	Secondary Choice	Reverberations	Loudness
18	K	3	K	Knoll, big blast.	--	--	Hollow, diffuse.
[We are across from the fence (we moved).]							
19	T <sub>p</sub>	4	K	Knoll and TSBD.	--	--	Crack, then blast - crack is above Knoll.
20	T <sub>p</sub>	4	K	Knoll and TSBD.	--	--	Same as 19.
21	T <sub>2</sub>	4	K	Knoll, big blast.	--	--	From right in front of us.
22	K	4	T	Knoll and TSBD	--	--	Crack then blast, similar to 19, less blast than 19.
23	T <sub>p</sub>	4	T	Knoll and TSBD.	--	--	Like 22.
24	T <sub>2</sub>	4	T	TSBD	--	--	Sharp crack from 6th floor.
25	K	4	K	Knoll	--	--	Like 19.



ADDENDUM A: REPORT ON THE TEMPERATURE IN DALLAS, TEX.,  
NOVEMBER 22, 1963



**U.S. DEPARTMENT OF COMMERCE**  
**National Oceanic and Atmospheric Administration**

ENVIRONMENTAL DATA SERVICE

National Climatic Center

Federal Building

Asheville, N. C. 28801

March 23, 1979

Reply to: D5422/MR/lbd/(09684)

Mr. Gary Cornwell  
Deputy Chief Counsel-Select  
Committee on Assassinations  
House Office Building Annex No. 2  
Washington, DC 22180

This is in response to your telephone call of 3/22/79.

We are furnishing the materials listed below:

DEPARTMENT OF COMMERCE CERTIFIED COPIES:

SURFACE WEATHER OBSERVATIONS

Dallas, Love Field, Texas

November 22, 1963

*Daniel B. Mitchell*

Daniel B. Mitchell  
Director

## U. S. DEPARTMENT OF COMMERCE

FORM CD-44  
(REVISED)  
PRESCRIBED BY  
D.A.O. 201-17

Asheville,  
North Carolina

March 23, 1979

I HEREBY CERTIFY that the annexed is a true copy of the SURFACE WEATHER  
OBSERVATIONS for Dallas (Love Field), Texas, November 22, 1963

on file in the National Climatic Center, Asheville, North Carolina

Clyde M. Branks  
Technical Assistant  
Information Services Division  
(Official title)

I HEREBY CERTIFY that Clyde M. Branks  
who signed the foregoing certificate, is now, and was at the time of signing, Technical Assistant,  
Information Services Division, National Climatic Center

and that full faith and credit should be given his certificate as such.

IN WITNESS WHEREOF, I have hereunto subscribed my name,  
and caused the seal of the Department of Commerce to be af-

fixed this Twenty-  
third day of March,

one thousand nine hundred and Seventy-nine

For the SECRETARY OF COMMERCE:

William M. The Murray  
Daniel B. Mitchell  
Director, National Climatic Center  
Certifying Officer



\* U.S. Government Printing Office: 1975 O-338-884

DATE NOV 22 1963



ADDENDUM B: REPORT ON WIND CONDITIONS IN DALLAS, TEX.,  
NOVEMBER 22, 1963



U.S. DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
ENVIRONMENTAL DATA SERVICE  
National Climatic Center  
Federal Building  
Asheville, N. C. 28801

March 30, 1979

Reply to: D5422/MR/lbd/(09684)

Mr. Gary Cornwell  
Deputy Chief Counsel  
Select Committee on Assassinations  
House Office Building Annex No. 2  
Washington, DC 22180

This is in response to your telephone call of 3/22/79 and related correspondence.

We are furnishing the materials listed below:

DEPARTMENT OF COMMERCE CERTIFIED COPY:

WIND GUST RECORDER CHART  
Dallas Naval Air Station, Texas  
November 22, 1963

*Daniel B. Mitchell*

Daniel B. Mitchell  
Director

## U. S. DEPARTMENT OF COMMERCE

FORM CD-64  
(REVISED)  
PRESCRIBED BY  
O.A.O. 201-17

Asheville,  
North Carolina

~~WINDOMETER~~ March 30, 1979

I HEREBY CERTIFY that the annexed is a true copy of the WIND GUST RECORDER  
CHART for Dallas Naval Air Station, Texas, November 22, 1963

on file in the National Climatic Center, Asheville, North Carolina

*Clyde M. Branks*  
Technical Assistant  
Information Services Division  
(Official title)

I HEREBY CERTIFY that Clyde M. Branks  
who signed the foregoing certificate, is now, and was at the time of signing, Technical Assistant,  
Information Services Division, National Climatic Center  
and that full faith and credit should be given his certificate as such.

IN WITNESS WHEREOF, I have hereunto subscribed my name,  
and caused the seal of the Department of Commerce to be af-

fixed this Thirtieth day of March,  
one thousand nine hundred and Seventy-nine

For the SECRETARY OF COMMERCE:

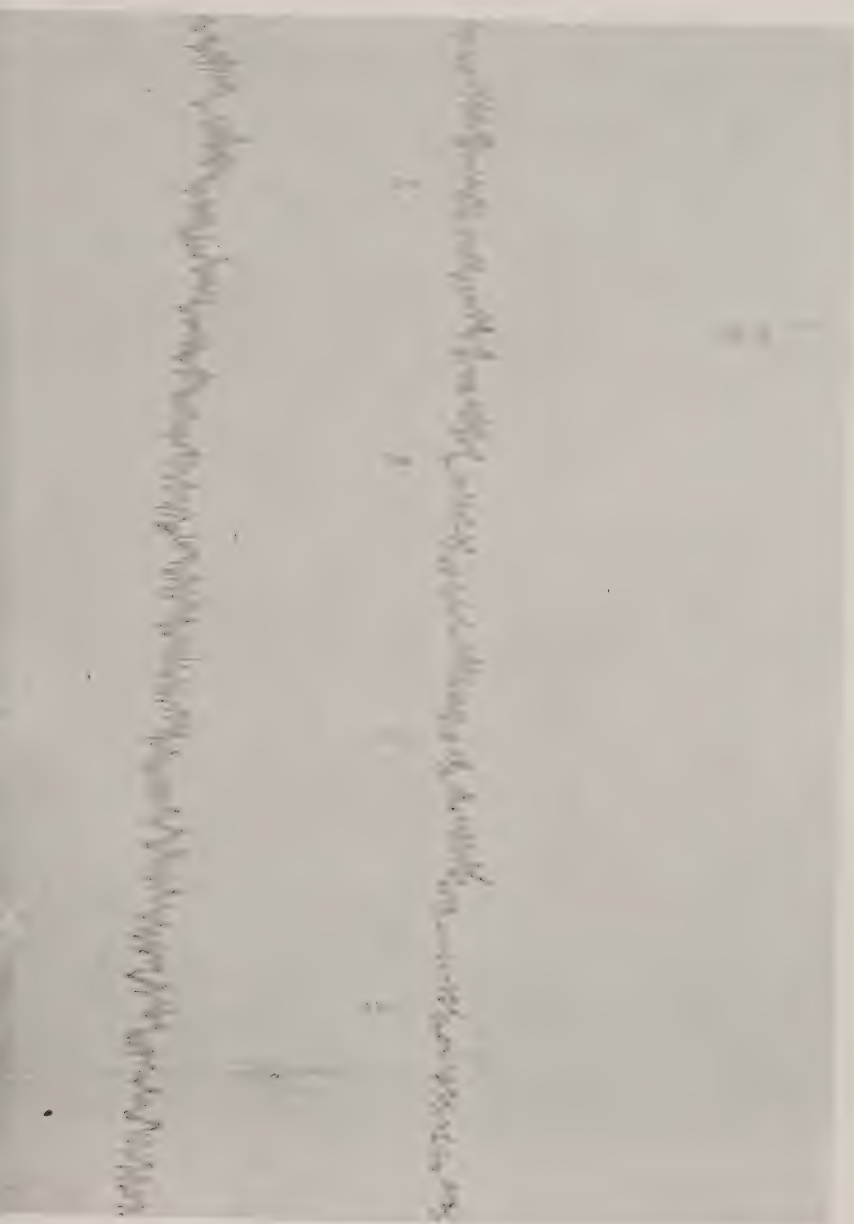
*Daniel B. Mitchell*  
Daniel B. Mitchell  
Director, National Climatic Center  
Certifying Officer



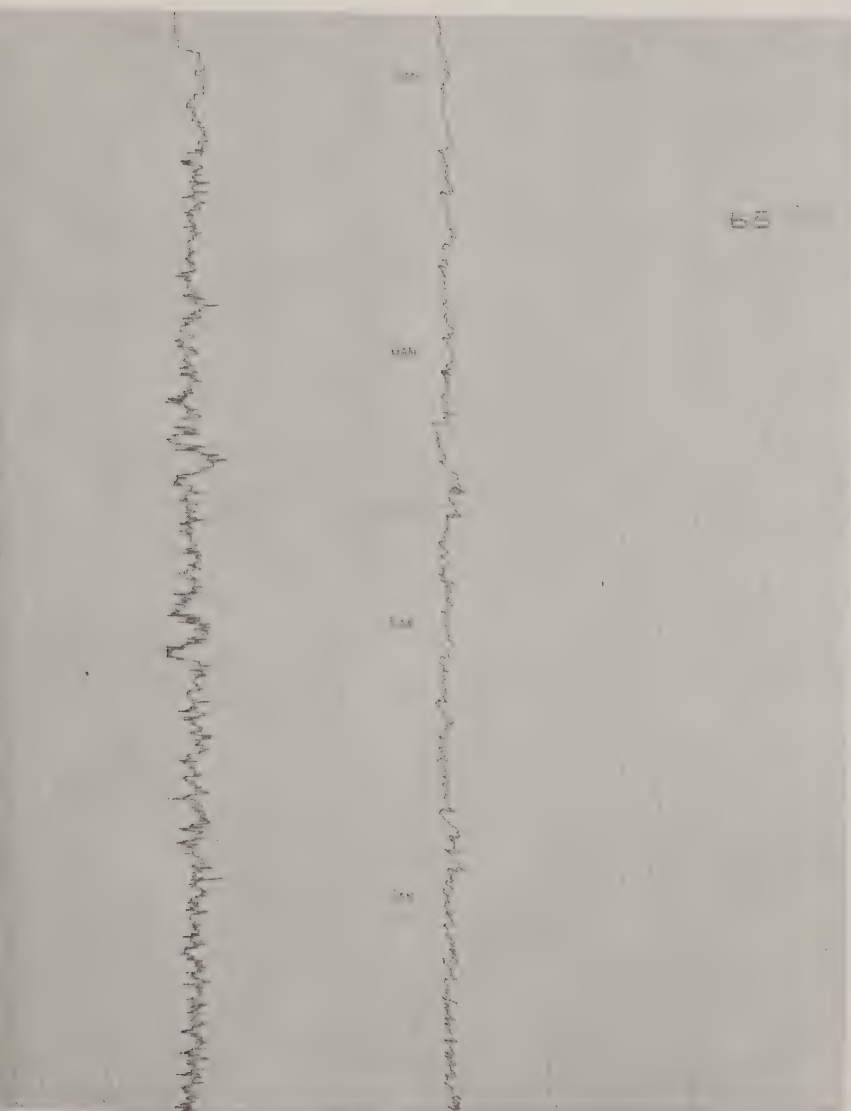
The first of these is the fact that the  
 system is not a simple one, and that  
 the results are not always the same.  
 The second is that the system is not  
 always the same, and that the results  
 are not always the same.

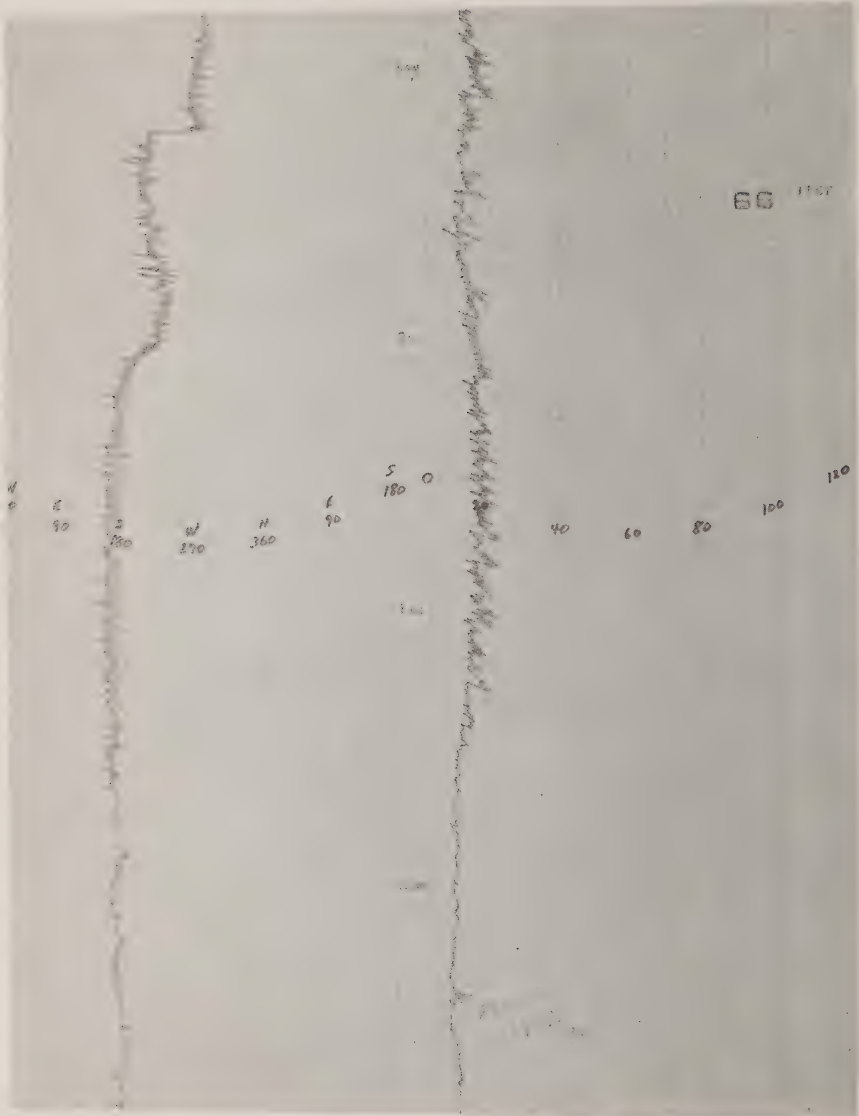














ADDENDUM C: MEMORANDUM FROM G. ROBERT BLAKEY TO THE SELECT  
COMMITTEE ON ASSASSINATIONS ON THE MANNLICHER-CARCANO  
FIRING TEST

MEMORANDUM

TO: ALL COMMITTEE MEMBERS

FROM: G. Robert Blakey, Chief Counsel and Director

SUBJECT: Test on Mannlicher-Carcano

DATE: March 22, 1979

Yesterday, with the assistance of Sgt. Cecil Kirk and other members of the D. C. Police Department, the staff conducted a second test of the time necessary to fire two consecutive rounds from a 6.5 mm Mannlicher-Carcano rifle similar to that found on the 6th floor of the Texas School Book Depository on November 22, 1963. The test was conducted primarily to answer the question, would it have been possible for Lee Harvey Oswald to fire two shots in less than 1.7 seconds? Our test shows that it is.

As you recall, the estimated trigger pulls for the shots that the acoustics analysis identified as #1 and #2 occurred approximately 1.66 seconds apart. (See my previous memo on correlating the shots)

In addition, the test was designed to provide some insight into the difficulty Oswald would have encountered in firing three consecutive shots within 8.31 seconds, at least two of which were less than 1.7 seconds apart, and at least two of which hit the targets at the noted ranges.

From knowledge of the difficulty involved in so shooting, it may be possible indirectly to infer something about the probability, as opposed to the possibility, that Oswald did so. Nevertheless, even the most improbable event may have occurred. Thus, to answer the ultimate question of whether Oswald did fire the first two shots 1.66 seconds apart and hit his target at least once in so doing, as much information as available in addition to that gathered in yesterday's testing should obviously be taken into consideration. This, of course, was what the Committee did in reaching its decisions on December 29, 1978, when it reviewed the previous test firing data, together with other evidence such as the acoustics analysis, and the physical evidence (e.g. the three empty shell casings found on the TSBD 6th floor).

The test was conducted yesterday between 10:00 a.m. and noon at the Lorton Correctional Facility firing range in Virginia. The National Archives, represented by Mr. David Paynter, brought the Oswald rifle (C.E. 139) for use in the test, but bench rest firing tests and operation of the weapon established that it was in too poor condition to be used. (The Committee's Firearms Panel had previously noted the weapon's deterioration since 1963, and their final report reflects the specific nature of the deterioration). Consequently, a similar weapon was used for the actual testing. This rifle was one of the two previously used in August, 1978 for the tests in Dealey Plaza and will be turned over to the Archives as part of the Committee's files at the end of this month.

The shots were fired from a two story tower (approximately 20 feet high), at three targets, stationed from left to right at distances of 143, 165 and 266 feet from the tower.<sup>1/</sup> The rifle was shot by four expert marksmen from the D.C.P.D., Officers D. M. Smith, B. L. Miller, Joe Masson, and E. E. Lewis, and two inexperienced staff members, Deputy Chief Counsel Gary Cornwell and myself. Also present were Sgt. Cecil Kirk and Officer M. D. Gonzales, the D.C.P.D. Range Instructor. All members of the D.C.P.D. who fired the rifle had prior military experience. Officers Lewis and Smith had additional extensive civilian training in the use of rifles, while officers Miller and Masson had similar extensive training in the use of handguns. Each of the officers thus can be considered experts in the use of such weapons. Gary Cornwell and I have had neither military nor civilian training in the use of firearms, although I hunted with rifles as a boy, and Cornwell has hunted with rifles periodically throughout his adult life.

Each shooter practiced working the bolt for several minutes (usually 2 to 3 minutes) before shooting. All shots were fired using open iron sights. All times were determined by 3 handheld stop watches. Only 35 shells were fired, including those expended in preliminary tests to determine if the weapon operated properly.<sup>2/</sup> Each officer fired two series of three shots and Cornwell and I each fired one series of two shots.

The test established the following:

(1) The weapon can be quite accurately fired more rapidly using open iron sights than the FBI tests in 1963 indicated, where the telescopic sight was used. For example, Officer Masson, during one test series, hit the body silhouette at 143 and 165 feet on the first two shots, and missed the head portion of the silhouette at 266 feet on the third shot by approximately one inch (1"), taking 2.0 seconds between shots 1 and 2, and a total of less than 5 seconds for all three shots. Two other series, one by officer Smith and another, again, by Officer Masson, were fired in which only 1.9 seconds elapsed between two shots, and one of the three shots scored a "kill".<sup>3/</sup>

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<sup>1/</sup> The distances were chosen upon the assumption that the 4th shot (Oswald's third) hit the President in the head at frame 312.

<sup>2/</sup> We found that the weapon was characteristically difficult to operate, due to its poor basic design, and in addition, the particular weapon we used had badly worn riflings and therefore shot somewhat inaccurately.

<sup>3/</sup> Normal target range body silhouettes, portraying an individual from waist to head, were used as targets. A "kill" was judged to be any shot that hit the silhouette. A "miss" was scored even if the bullet struck the target background, but not within the silhouette.

(2) It is apparently difficult, but not impossible -- at least with only minimal practice with the firearm used -- to fire 3 shots, at least two of which score "kills", with an elapsed time of 1.7 seconds or less between any two shots, even though, in the limited testing conducted, no shooter achieved this degree of proficiency.

(3) It is not difficult to fire two consecutive shots from a Mannlicher-Carcano within 1.66 seconds, and to "point aim", if not carefully "sight" it, on the target on each shot. Cornwell fired the rifle twice in 1.2 seconds, and I fired it twice within 1.5 seconds. In both cases the second shot missed, but was close to the silhouette. In fact, my second shot only missed the silhouette by approximately 2".<sup>4/</sup>

(4) There was ample time for Oswald to have fired 3 shots, hitting with two of them, within 8.31 seconds. All series of 3 shots were fired in less than 8 seconds, two were fired in less than 7 seconds, two in less than 6, and two in less than 5.<sup>5/</sup>

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<sup>4/</sup> The first shot in the test series, of course, routinely scored "kills" since there was no time pressure imposed in aiming the rifle in preparation for that shot.

<sup>5/</sup> In light of the difficulty involved in making the first two shots in 1.66, I note that showing that it is possible does not offer any reason why he would have acted so quickly after the first miss.





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THE ANALYSIS OF YURI NOSENKO'S POLYGRAPH  
EXAMINATION

Submitted by

Richard O. Arther, President, Scientific Lie Detection, Inc., New York,  
N.Y., and Director, National Training Center on Polygraph Science

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Report to the

Select Committee on Assassinations

U.S. House of Representatives

Ninety-fifth Congress

Second Session

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March 1979

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## INTRODUCTION\*

- (1)\*\* As part of its investigation into the possibility that Lee Harvey Oswald was involved in a conspiracy to assassinate John F. Kennedy, the select committee looked into whether he might have been a Soviet agent.
- (2) One controversial source of information on this point has been a former high-ranking KGB official, Yuri Ivanovich Nosenko. Nosenko had been, on two occasions, in charge of coordinating surveillance and recruitment of American tourists in Russia. At the time of Oswald's defection to Russia, Nosenko claimed to have personally reviewed Oswald's file.
- (3) In February 1964, Nosenko defected to the United States and was placed under custody of the Central Intelligence Agency. Because of strong doubts within the Agency that Nosenko was a bona fide defector, he was later placed in solitary confinement for 3 years. He was subjected to extensive interrogation, and during three periods took polygraph examinations: April 4, 1964; October 18, 1966; and August 6, 1968. The examinations were wide-ranging, but only the second dealt with Oswald in any depth. On all occasions, Nosenko maintained categorically that the KGB had never been interested in Oswald and had never used him as an agent.
- (4) The polygraphist conducting the first two tests concluded that on the first test Nosenko had lied, though not to the Oswald question. On the second, he had lied to two of the Oswald questions. Another polygraphist conducted the third test. He concluded that Nosenko was answering truthfully.
- (5) In the 1970's, the CIA investigated the overall handling of the Nosenko matter and concluded, with respect to the first two polygraph tests, that they should be considered "invalid or inconclusive" because of deficiencies in the way they were conducted. For example, the first had been designed principally to create a hostile atmosphere for Nosenko. The polygraphist was instructed to tell Nosenko that the tests showed he was lying, regardless of what they actually showed. (The expert, in fact, interpreted the results as showing that Nosenko was lying.) However, the CIA did conclude that the third examination was valid and that the results could be considered credible.
- (6) The Warren Commission was aware of the Nosenko issue, but was unable to make much of it since most of the material was classified and unavailable. Similarly, critics of the Warren Commission have not dealt with it in any depth.

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\*Materials submitted for this report by the committee's polygraph consultant were compiled by HSCA staff members G. Robert Blakey and Whitney Watriss.

\*\*Arabic numerals in parentheses at the beginning of paragraphs indicate the paragraph number for purposes of citation and referencing; italic numerals in parentheses in the middle or at the end of sentences indicate references which can be found at the end of each report or section.

(7) The select committee decided to have an independent analysis of the polygraph tests conducted. First, such an examination had never been carried out. Second, it wished to know if the tests had been properly conducted and interpreted and if the answers could be considered credible. If so, then it could be stated with considerable certainty that Nosenko was a valuable source of information. If not, the committee would explore other avenues in order to decide what, if any, relation Oswald had to the KGB.

#### *Selection of the expert*

(8) The committee retained Richard O. Arther to conduct an independent analysis of the three polygraph tests taken by Nosenko. Arther had been a member of the committee's polygraph panel that examined the Jack Ruby and James Earl Ray polygraph tests. He had been selected because of his extensive qualifications and lack of prior involvement with either assassination investigation.

(9) Arther received a B.S. with honors in police science from Michigan State University in 1951, and an M.A. in psychology from Columbia University in 1960. Arther has been in private practice in New York City since 1963. He founded Scientific Lie Detection, Inc., and cofounded the National Training Center of Polygraph Science. He has taught at Brooklyn College, Seton Hall University, the John Jay College of Criminal Justice and the Graduate School of Public Administration of New York University.

(10) Arther has authored over 200 professional articles and two books. He is a member of the Academy of Certified Polygraphists and the American Polygraph Association.

#### *Procedures*

(11) As noted, Arther was asked to analyze the material related to the three examinations to determine if they had been validly conducted and interpreted and if the results were credible. On June 2, 1978, he made the first of three trips to CIA headquarters in Langley, Va. Following procedures standard for an analysis of past polygraph tests, he reviewed the polygraph charts "blind," that is, without any knowledge of whether the questions were control, relevant, or irrelevant. The purpose was to try to determine solely from the tracings on the charts to which questions Nosenko appeared to be lying. This procedure was followed on two separate occasions. After each review, Arther then checked the question sheets to determine which questions were control, relevant, or irrelevant (see below for an explanation of these terms).

(12) The other trips were made on June 7 and August 24. Subsequently, Arther submitted his final report, which appears in full following this introductory section.

#### *A polygraph examination*

(13) A polygraph examination records physiological responses to questions asked. The polygraphist attempts to design the examination in such a way that the truthful person will react to the control questions and the lying person to the relevant questions. The test structure must be constructed so that it poses a threat to both the truthful and untruthful person. The polygraphist attempts to determine the "psychological set" of the examinee. He tries to determine, by reading the physiological activity of the examinee in the polygraph charts, what



questions or question areas pose the greatest threat to the examinee's well-being. A "psychological set" is "a person's fears, anxieties, and apprehension, [which] are channeled toward that situation causing the greatest threat to the individual's well-being. He will tune in on that which is of a greater threat, and tune out that of a lesser threat."\*

(14) Responses to questions are recorded on a polygraph chart, which consists of tracings produced by three different types of psychological reactions associated with the circulatory, nervous, and respiratory systems:

1. The breathing pattern is recorded by means of a rubber tube placed around the person's chest.
2. The Galvanic skin response is measured by placing the attachments on either the fingers or the palms.
3. Changes in blood pressure, heart beat, and pulse rate are obtained by a standard blood pressure cuff placed around the upper arm.

(15) Questions are broken down into three categories:

1. Relevant—those pertinent to the investigation.
2. Irrelevant—hopefully, meaningless, nonemotion-producing ones to get the person used to being questioned and giving answers.
3. Control—nonrelevant, to which it can be assumed the person will lie during the test. These provide a standard for comparing the responses to relevant questions. If a person reacts more to a proper control question than to the relevant questions, then he is considered to be truthful to the relevants. On the other hand, if he reacts more to the relevants than to the proper control question, he is considered to be lying to the relevants.

(16) Relevant, irrelevant, and control questions are interspersed throughout the polygraph chart. The examination may consist of various series covering various relevant issues. Each relevant issue must be asked a minimum of two times in a series, but as many times as necessary to conclude that relevant issue successfully. Each series should have a minimum of two charts, but as many charts as necessary to conclude the relevant issues in that series successfully.

(17) The procedure for a polygraph examination is as follows: The polygraphist first conducts a pretest interview, during which the test questions are read to the person exactly as they are going to be asked. It is vital that all questions be properly worded and discussed with the person. Then the actual test is conducted.

#### FINDINGS AND CONCLUSIONS OF RICHARD O. ARTHUR

##### *Materials examined*

(18) On June 2, 1978, I went to Central Intelligence Agency headquarters to study the polygraph examinations administered by the CIA to Yuri Ivanovich Nosenko. I was given what they claimed was the complete file. When I asked for the polygraphists' handwritten notes, handwritten question sheets, chart analyses and other papers from the examinations, I was again told I had the complete file. This amazed me, since I had been given only official reports, typed test

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\*From the Curriculum of the U.S. Army Provost Marshal General Polygraph School, Ft. McClellan, Georgia.

questions and charts. Handwritten notes have always been included in every polygraph file I have ever reviewed. Either on this day, June 2, or on June 7 (the date of my second visit), I asked for the tape recordings from the examinations. I was told there were none. This also greatly surprised me.

(19) On both June 2 and June 7, CIA polygraphists were assigned to me to provide all the background information they had on all three examinations. I was assured that they were holding nothing back.

(20) My third trip to the CIA headquarters was on August 24. Again I had a polygraphist assigned to me. I was given only material provided in June.

### *Procedures*

#### *June 2 visit*

(21) The purpose of this visit was to get an overview of Nosenko's polygraph examinations, including the quality of the test questions and testing procedures, and to conduct an analysis of the polygraph recordings to determine if I agreed with the interpretations of the CIA polygraph experts.

(22) I spent the first several hours analyzing the polygraph reactions—without knowing if any given question was a relevant, irrelevant, or control. Such a procedure is referred to as a “blind chart analysis” and is a standard one, designed to eliminate all preconceived opinions a polygraphist might have as to a person's truthfulness. That is, I formed my opinions as to Nosenko's truthfulness to each test question prior to knowing if any given question was a relevant, irrelevant, or control.

(23) Only after I finished this blind chart analysis did I learn which questions were relevant, irrelevant, or control. I then determined if I agreed with the CIA expert's analysis of Nosenko's polygraph recordings.

(24) On June 2, Kenneth Klein, committee counsel, asked if I wanted to conduct my own polygraph examination of Nosenko and/or personally interview the two CIA polygraph experts. I replied that I would consider both possibilities.

#### *June 7 visit*

(25) On June 7, I returned to CIA headquarters to reevaluate the polygraph examinations, decide if Nosenko should be given another polygraph examination, and determine if interviews of the two CIA experts would prove beneficial. I also did another blind chart analysis to determine if I was consistent with my June 2 analysis. The results were substantially identical.

#### *August 24 visit*

(26) The objective of this visit was to reevaluate the charts and question sheets to make sure that my preliminary written report was as accurate as possible. I had had to write it from memory as the CIA requested I not take my notes away from the Agency's control.

### *Evaluation of the polygraph examinations*

#### *April 4, 1964*

(27) The April 4, 1964, examination was administered exactly 2 months after Nosenko had defected. It consisted of more than 50 relevant questions, divided into 13 individual tests. (The great major-

ity of polygraph examinations are limited to three or four relevant issues.)

(28) It was obvious that the CIA's purpose was to determine Nosenko's truthfulness to a wide variety of issues. Only one question in one test dealt with Lee Harvey Oswald: "Did you tell us the truth about Lee Harvey Oswald?" The answer was "Yes."

(29) The wording of this question is very general. It is the type of broad question that many polygraphists use only at the very end of a test, after at least three or four relevant questions have been asked on the same issue.

(30) Further, this question was the 51st one asked. It occurred in the 12th test and was the 3rd of 11 questions in the test. Because important questions are generally placed at the beginning, with questions of lesser importance near the rear, it would appear that the Oswald issue had an extremely low priority.

(31) As noted, in this examination over 50 relevant questions were asked. Fred E. Inbau and John E. Reid, authors of the classic textbook on polygraphy, *Lie Detection & Criminal Interrogation* (3d edition, 1953), recommended that no more than three relevant test questions be asked. This is because the more a person is asked relevant questions, the more likely he will become "test-tired," that is, even though lying, he will not react because he has become emotionally exhausted.

(32) Further compounding this situation, the examination started at 10:45 a.m. and ended at 3:15 p.m.—a period of 4½ hours—whereas the usual polygraph examination lasts less than 2 hours, with four or five separate tests. Again there is a definite risk that a person will become "test-tired" if the examination runs too long.

(33) Although the CIA expert's opinion was that Nosenko gave a "reaction" (I presume by this he means that Nosenko was "lying") to 6 of the 11 questions, he listed Nosenko as showing "no reaction" to the Oswald question.

(34) In both my blind chart analyses, I picked the Oswald question as showing the greatest valid "lie" reaction by Nosenko, certainly greater than those for the six questions indicated by the CIA expert as having produced lies.

(35) In spite of all the above problems, which would normally lead a polygraphist to believe that Nosenko should be "emotionally unresponsive," Nosenko gives a substantial "lie" reaction to the Oswald question.

### *October 18, 1966*

(36) The October 18, 1966, examination was administered by the same CIA polygraphist who had administered Nosenko's 1964 examination. In his written report, dated October 23, 1966, he stated:

(37) The specific purpose of the October 18, 1966, polygraph test was to:

a. Attempt to establish whether subject was in fact actually involved in the *Oswald* case while *Oswald* was in the Soviet Union, or if his association with the *Oswald* case was only part of his cover story legend.

b. Determine if subject was personally active in the *Oswald* case in 1963 after President Kennedy's assassination.



c. Ascertain if subject received special instructions from KGB to pass on to the American Government regarding the *Oswald* case.

(38) This series of examinations began on October 18 and ended on October 28. The thrust of the first day of examinations had to do with Oswald. The subsequent examinations, that is, October 19 through October 28, had nothing to do with Oswald. It would appear that the CIA now fully appreciated the significance of Nosenko/Oswald, and that their polygraphist was doing his best to determine Nosenko's truthfulness regarding Oswald.

(39) During the examination, Nosenko was asked 32 questions in which the name Oswald appears. On my blind analysis, I selected the following questions as containing valid indicators of lying:

1. Did you receive special instructions about what to tell Americans about the Oswald case? (No)
2. Was Oswald recruited by the KGB as an agent? (No)
3. Did the KGB consider Oswald abnormal? (Yes)
4. To your knowledge did Oswald talk to a KGB officer in Mexico? (No)
5. Is your contact with the *Oswald* case part of your legend? (No)
6. Did you hear of Oswald prior to President Kennedy's assassination? (Yes)
7. Did you hear of Oswald only after President Kennedy's assassination? (No)
8. Did you personally order \_\_\_\_\_, in 1959, to collect material on Oswald? (Yes)
9. Did the KGB instruct you to tell us Oswald was a bad shot? (No)
10. Did the KGB give the Oswalds any kind of help in their departure from the Soviet Union? (No)

(40) When a liar is asked a large number of relevant test questions, he will not react as lying to all questions. Instead he will pick out the questions most significant to him and react as lying only to those. Generally, the questions he does not regard as significant, he will not react to, even though he is lying.

(41) On test series 1, the CIA expert wrote that the "most significant reactions" were to questions 1 and 6 above. For test series 2, the CIA expert wrote that the "most significant reactions" were to questions 5, 6 and 7 above, plus two questions not on my list.\*

(42) By having the Oswald questions the first day of this second series of polygraph examinations, both the validity and reliability were greatly increased.

*August 6, 1968*

(43) The third series of polygraph examinations was administered in August 1968. These examinations were conducted by a different CIA polygraph expert. The first series of tests was administered on August 2.

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\*Since my blind analysis involved selecting only the two or three questions to which Nosenko was reacting the most strongly within each test, I did not expect to agree fully with the CIA expert.



(44) Twenty-three relevant test questions were asked, but not one had to do with Oswald. The second day of testing was August 6, 1968. At this time, 27 relevant questions preceded the first Oswald question, of which there were 2.

(45) It is obvious that once again the Oswald issue was considered extremely minor. As noted, the Oswald questions did not occur until quite far into the procedure. The longer a question is postponed, the more likely a liar will come out as "truthful" because he has become "test-tired," that is, unresponsive. On the first day, the polygraphist himself acknowledged the possibility of Nosenko's becoming unresponsive when he wrote, after the sixth test of August 2, 1968:

No further polygraph tests were administered on this date because the examiner did not want to run the risk of fatigue setting in and thus possibly causing adrenalin exhaustion.

(46) Thus he stopped on August 2, after 6 tests and 23 relevant questions. Yet on the second day of testing (August 6), it was not until test 7 and the 28th relevant question that he first asked about Oswald.

(47) Further, the wording of the two Oswald questions was very startling:

1. Did you actually review the KGB file on Oswald? (Yes)
2. Did Lee Harvey Oswald receive any KGB training or assignments? (No)

(48) No date was referred to within this first question, a serious error in wording. Nosenko was claiming that he had reviewed Oswald's file before the assassination. Therefore, the question should have been worded:

(49) "Before November 1963, had you actually reviewed Oswald's KGB file?" Leaving out the date meant that Nosenko could have truthfully answered this question even if he had first reviewed Oswald's file after the assassination. In fact, he could have reviewed it 1 week before he was told to defect and still come out as truthful to the question.

(50) The second question is also very poor in that it has the word "or" in it, which automatically means that it is really two questions. When there are two questions within one question, if a person happens to be truthful to one of those questions and lying about the other, generally he will come out as truthful.

(51) For example, if Oswald did not receive any KGB training but was told to assassinate President Kennedy, Nosenko could possibly truthfully answer "yes" to this question.

#### *Comparison of 1966 and 1968 examinations*

(52) Not only was the first day of the 1966 examination directed totally toward the Oswald issue, but the questions were very specific and basically worded properly. In 1968, neither was the case.

(53) In 1966, the CIA polygraph expert rendered an opinion that Nosenko was lying both about why he defected and as about Oswald. On the other hand, in 1968, the polygraphist rendered an opinion that Nosenko was "substantially truthful." This second expert even had Nosenko answering truthfully to the question: "Is there any possibility that the KGB would dispatch an officer to defect to the Americans?" Answer: "No."

(54) The HSCA has informed me that without exception every intelligence officer interviewed—including KGB defectors—has stated that the KGB is capable of dispatching an officer to defect. The fact that Nosenko denies this and the polygraphist finds him truthful makes the entire examination suspect.

### *Opinions*

(55) 1. For two major reasons, there would be no point in interviewing the two CIA polygraph experts. First, the charts spoke for themselves. Second, since I supposedly had the complete case file, I would rather go by the file than by someone's memory of what happened some 10 to 14 years ago.

(56) 2. Another polygraph examination is not recommended for Nosenko. After such a long period of time and such extensive testing, the results could not be trusted.

(57) 3. The polygraph examination given on October 18, 1966, should be considered the most valid and reliable of the three regarding Lee Harvey Oswald. Given the state of the art in 1966, this examination met the criteria of validity and reliability.

(58) 4. Both the 1964 and 1968 examinations involving Lee Harvey Oswald should be disregarded because of the large number of inherent deficiencies in both examinations.

(59) 5. On another occasion, I provided four questions which I would have asked had I examined Nosenko:

Did the KGB order Oswald to assassinate President Kennedy?

Before November 1963, had you ever heard of Lee Harvey Oswald?

Did the KGB order you to defect?

Did the KGB instruct you what to tell the Americans about Oswald?

(60) *Note:* My August 16, 23, 24, and 28 review of the reports, charts, and my blind chart analysis at the Select Committee on Assassinations' offices served only to strengthen the above opinions.

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THE ANALYSIS OF JACK RUBY'S  
POLYGRAPH EXAMINATION

Submitted by

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Report to the

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## INTRODUCTION\*

(1) On July 18, 1964, Jack Ruby voluntarily took a polygraph examination to test his truthfulness. Even though the Warren Commission disclaimed any reliance on the results of the test, (1) the committee believed that popular interest in such tests, as well as the possibility that new investigative "leads" might emerge, warranted a review of the examination.

(2) The committee was specifically prohibited by its own rules (2) from using either failure or agreement to take a polygraph examination, or the results of a polygraph examination, as a basis for fact-finding in any public hearing or report. Such restrictions did not apply, however, to a review of polygraph tests previously administered. The committee therefore engaged a panel of experts to review the Ruby polygraph examination to determine if it was properly conducted and analyzed.

### *A polygraph examination*

(3) A polygraph examination records physiological responses to questions asked. The polygraphist attempts to design the examination in such a way that the truthful person will react to the control questions and the lying person to the relevant questions.

(4) The test structure must be constructed so that it poses a threat to both the truthful and untruthful person. The polygraphist attempts to determine the "psychological set" of the examinee. He tries to determine, by reading the physiological activity of the examinee in the polygraph charts, what questions or question areas pose the greatest threat to the examinee's well-being. A "psychological set" is "a permission disclaimed any reliance on the results of the test, (1) the son's fears, anxieties, and apprehensions, [which] are channeled toward that situation causing the greatest threat to the individual's well-being. He will tune in on that which is of a greater threat, and tune out that of a lesser threat." (3)

(5) Responses to questions are recorded on a polygraph chart, which consists of tracings produced by three different types of psychological reactions associated with the circulatory, nervous, and respiratory systems:

(6) 1. The breathing pattern is recorded by means of a rubber tube placed around the person's chest.

(7) 2. The Galvanic skin response is measured by placing the attachments on either the fingers or the palms.

(8) 3. Changes in blood pressure, heart beat and pulse rate are obtained by a standard blood pressure cuff placed around the upper arm.

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(9) Questions are broken down into three categories:

1. Relevant—those pertinent to the investigation.
2. Irrelevant—hopefully meaningless, nonemotion-producing ones to get the person used to being questioned and giving answers.
3. Control—nonrelevant to which it can be assumed the person will lie during the test. These provide a standard for comparing the responses to relevant questions. If a person reacts more to a proper control question than to the relevant questions, then he is considered to be truthful to the relevants. On the other hand, if he reacts more to the relevants than to the proper control question, he is considered to be lying to the relevants.

(10) Relevant, irrelevant, and control questions are interspersed throughout the polygraph chart. The examination may consist of various series covering various relevant issues. Each relevant issue must be asked a minimum of two times in a series, but as many times as necessary to conclude that relevant issue successfully. Each series should have a minimum of two charts, but as many charts as necessary to conclude the relevant issues in that series successfully.

(11) The procedure for a polygraph examination is as follows. The polygraphist first conducts a pretest interview, during which the test questions are read to the person exactly as they are going to be asked. It is vital that all questions be properly worded and discussed with the person. Then the actual test is conducted.

#### *Ruby's polygraph examination*

(12) Jack Ruby had repeatedly requested that he be examined with a polygraph, truth serum, or other scientific means to test his veracity. (4) In his testimony before the Warren Commission on June 7, 1964, he stated, "I would like to be able to get a lie detector test or truth serum of what motivated me to do what I did at that particular time \* \* \*." (5) Chief Justice Earl Warren responded,

\* \* \* if you and your counsel want any kind of test, I will arrange it for you. I would be glad to do that, if you want it. I wouldn't suggest a lie detector test to testify the truth \* \* \*. (6)

Ruby repeated his request several times during his testimony.

(13) Following numerous discussions among attorneys for Ruby and his family and other interested parties, (7) on July 18, 1964, (8) Ruby (9) took the examination signing a standard "Consent to Interview with Polygraph" form. (10)

(14) The following persons were present during the examination, in addition to the expert, SA Herndon: (11)

1. Arlen Specter, Warren Commission counsel;
2. Clayton Fowler, Ruby's attorney;
3. William R. Beavers, Ruby's psychiatrist;
4. James Woods, FBI special agent;
5. E. L. Holman, chief jailer;
6. Odell Oliver, court reporter.

(15) In addition to the above, Joe Tonahill, Ruby's other attorney, and William Alexander, assistant district attorney for Dallas County, Tex., were present at each of the 13 pretest interviews. (12) Clayton Fowler, Ruby's attorney, did not want Assistant District Attorney

William Alexander to hear Ruby's answers and insisted that Ruby not answer questions until the actual tests had begun and Alexander had left the examination room. (13) In some instances, however, Ruby did answer the questions during the pretest stage. Special Agent Herndon had indicated that he preferred to have Ruby answer the questions during the pretest interview, as this was a generally accepted polygraph procedure. (14)

(16) The polygraph examination lasted from 2:23 p.m. to about 9 p.m. (15) Ruby was asked a total of 101 questions, broken into 13 series. A pretest interview was conducted before each question series, at which time the questions were explained to Ruby. They were often rephrased for the actual tests.

(17) The following are the relevant questions and answers from all 13 test groups comprising the Ruby polygraph examination:

*Question.* Did you know Oswald before November 22, 1963?

*Answer.* No. (16)

*Question.* Did you assist Oswald in the assassination?

*Answer.* No. (17)

*Question.* Are you now a member of the Communist Party?

*Answer.* No. (18)

*Question.* Have you ever been a member of the Communist Party?

*Answer.* No. (19)

*Question.* Are you now a member of any group that advocates the violent overthrow of the U.S. Government?

*Answer.* No. (20)

*Question.* Have you ever been a member of any group that advocates violent overthrow of the U.S. Government?

*Answer.* No. (21)

*Question.* Between the assassination and the shooting, did anybody you know tell you they knew Oswald?

*Answer.* No. (22)

*Question.* Aside from anything you said to George Senator on Sunday morning, did you ever tell anyone else that you intended to shoot Oswald?

*Answer.* No. (23)

*Question.* Did you shoot Oswald in order to silence him?

*Answer.* No. (24)

*Question.* Did you first decide to shoot Oswald on Friday night?

*Answer.* No. (25)

*Question.* Did you first decide to shoot Oswald on Saturday morning?

*Answer.* No. (26)

*Question.* Did you first decide to shoot Oswald on Saturday night?

*Answer.* Yes. (27)

*Question.* Did you first decide to shoot Oswald on Sunday morning?

*Answer.* Yes. (28)

*Question.* Were you on the sidewalk at the time Lieutenant Pierce's car stopped on the ramp exit?

*Answer.* Yes. (29)

*Question.* Did you enter the jail by walking through an alleyway?

*Answer.* No. (30)

*Question.* Did you walk past the guard at the time Lieutenant Pierce's car was parked on the ramp exit?

*Answer.* Yes. (31)

*Question.* Did you talk with any Dallas police officers on Sunday, November 24, prior to the shooting of Oswald?

*Answer.* No. (32)

*Question.* Did you see the armored car before it entered the basement?

*Answer.* No. (33)

*Question.* Did you enter the police department through the door at the rear of the east side of the jail?

*Answer.* No. (34)

*Question.* After talking to Little Lynn, did you hear any announcement that Oswald was about to be moved?

*Answer.* No. (35)

*Question.* Before you left your apartment Sunday morning, did anyone tell you the armored car was on the way to the police department?

*Answer.* No. (36)

*Question.* Did you get a Wall Street Journal at the Southwestern Drug Store during the week before the assassination?

*Answer.* No. (37)

*Question.* Do you have any knowledge of a Wall Street Journal addressed to Mr. J. E. Bradshaw?

*Answer.* No. (38)

*Question.* To your knowledge, did any of your friends or did you telephone the FBI in Dallas between 2 or 3 a.m. Sunday morning?

*Answer.* No. (39)

*Question.* Did you or any of your friends to your knowledge telephone the sheriff's office between 2 or 3 a.m. Sunday morning?

*Answer.* No. (40)

*Question.* Did you go to the Dallas police station at any time on Friday, November 22, 1963, before you went to the synagogue?

*Answer.* No. (41)

*Question.* Did you go to synagogue that Friday night?

*Answer.* Yes. (42)

*Question.* Did you see Oswald in the Dallas jail on Friday night?

*Answer.* Yes. (43)

*Question.* Did you have a gun with you when you went to the Friday midnight press conference at the jail?

*Answer.* No. (44)

*Question.* Is everything you told the Warren Commission the entire truth?

*Answer.* Yes. (45)



*Question.* Have you ever knowingly attended any meetings of the Communist Party or any other group that advocates violent overthrow of the Government?

Answer. No. (46)

*Question.* Is any member of your immediate family or any close friend, a member of the Communist Party?

Answer. No. (47)

*Question.* Is any member of your immediate family or any close friend a member of any group that advocates the violent overthrow of the Government?

Answer. No. (48)

*Question.* Did any close friend or any member of your immediate family ever attend a meeting of the Communist Party?

Answer. No. (49)

*Question.* Did any close friend or any member of your immediate family ever attend a meeting of any group that advocates the violent overthrow of the Government?

Answer. No. (50)

*Question.* Did you ever meet Oswald at your post office box?

Answer. No. (51)

*Question.* Did you use your post office mailbox to do any business with Mexico or Cuba?

Answer. No. (52)

*Question.* Did you do business with Castro-Cuba?

Answer. No. (53)

*Question.* Was your trip to Cuba solely for pleasure?

Answer. Yes. (54)

*Question.* Have you now told us the truth concerning why you carried \$2,200 in cash on you?

Answer. Yes. (55)

*Question.* Did any foreign influence cause you to shoot Oswald?

Answer. No. (56)

*Question.* Did you shoot Oswald because of any influence of the underworld?

Answer. No. (57)

*Question.* Did you shoot Oswald because of a labor union influence?

Answer. No. (58)

*Question.* Did any long-distance telephone calls which you made before the assassination of the President have anything to do with the assassination?

Answer. No. (59)

*Question.* Did any of your long-distance telephone calls concern the shooting of Oswald?

Answer. No. (60)

*Question.* Did you shoot Oswald in order to save Mrs. Kennedy the ordeal of a trial?

Answer. Yes. (61)

*Question.* Did you know the Tippit that was killed?

Answer. No. (62)

*Question.* Did you tell the truth about relaying the message to Ray Brantley to get McWillie a few guns?

*Answer.* Yes. (63)

*Question.* Did you go to the assembly room on Friday night to get the telephone number of KLIF?

*Answer.* Yes. (64)

*Question.* Did you ever meet with Oswald and Officer Tip-pit at your club?

*Answer.* No. (65)

*Question.* Were you at the Parkland Hospital at any time on Friday?

*Answer.* No. (66)

*Question.* Did you say anything when you shot Oswald other than what you've testified about?

*Answer.* No. (67)

*Question.* Have members of your family been physically harmed because of what you did?

*Answer.* No. (68)

*Question.* Do you think members of your family are now in danger because of what you did?

*Answer.* [No response.] (69)

*Question.* Is Mr. Fowler in danger because he is defending you?

*Answer.* [No response.] (70)

*Question.* Did "Blackie" Hanson speak to you just before you shot Oswald?

*Answer.* No. (71)

### *Interpretations of the polygraph examination*

#### *Dr. Beavers' testimony.*

(18) The testimony of Ruby's psychiatrist, Dr. William Beavers, who was present during the examination, was taken by Specter immediately after the polygraph examination on July 18, 1964. (72) Beavers testified that he had examined Ruby 9 or 10 times and had diagnosed him as a "psychotic depressive." However, Beavers stated that on the day of the examination, the "depressive element" had diminished, (73) and that most of the time Ruby understood the questions and answered with an appreciation of reality. (74) The only questions that seemed to tap Ruby's underlying delusional state related to his opinion about the safety of his defense counsel or his family. (75) Beavers did caution, however, that he was not an expert in the area of "interrelationships between mental illness and the polygraph." (76)

#### *Special Agent Herndon's testimony*

(19) On July 28, 1964, Special Agent Herndon testified before the Warren Commission regarding his interpretation of the Ruby polygraph. (77) Referring to Beavers' testimony, which Herndon had heard on July 18, 1964, Specter questioned him about the validity of a polygraph examination of a psychotic depressive person as described by Beavers. Herndon responded that an examination of such a person would be inconclusive or invalid in view of the fact that a psychotic individual is divorced from reality, and the tracings of his polygrams could not be logically interpreted. (78)

(20) Specter then questioned Herndon about his interpretation of the polygraph examination based on the hypothesis that Ruby was in fact in touch with reality during the examination and understood the nature of the questions and the quality of his answers. Herndon testified that, assuming Ruby was mentally competent and sane, he would interpret the charts as indicating that there was no deception in Ruby's responses to the relevant questions in the examination, that Ruby answered all relevant questions truthfully. (79) During later testimony, when Herndon was questioned about specific questions, he again was careful to qualify his interpretation with the assumption that Ruby was of sound mind. Herndon made it clear that he would find the results inconclusive and the examination invalid in the event Ruby was not of sound mind. (80)

(21) Herdon did mention four factors that he believed should be considered in the overall evaluation of Ruby's polygraph examination. The factors involved the prior extensive interrogation of Ruby, the time elapsed since Ruby shot Oswald, the number of persons present during the polygraph examination, and the number of relevant test questions asked. Herndon stated:

Mr. SPECTER. Do you have anything to add which you think would be helpful to the President's Commission?

Mr. HERNDON. Yes. I would like to make a few additional comments with regard to this polygraph examination, in view of the fact that it was somewhat unique and unusual. I think these factors should be somewhat considered in the overall evaluation of the polygraph examination.

First of all, Ruby has obviously been extensively interviewed by law enforcement officers and by the Commission and other people, and there has been a considerable length of time lapse since the time that the instant offense occurred of him shooting Oswald. These factors of length of time and considerable previous interrogation would tend to detract or negate any specific or definite conclusion that could be rendered with regard to the polygraph examination.

The fact that there were other personnel in the room would tend to negate a valid polygraph technique. However, here again I did mention that this did not appear to bother Mr. Ruby. But it should be considered and made a matter of record.

One other point I would like to mention, and that is the large number of relevant questions asked Mr. Ruby during this particular examination. This is not general standard procedure. However, I realize that the President's Commission wanted to cover many facets, and that it was mutually agreed upon that we would ask the questions that the Commission had originally drawn up for this particular interrogation. In normal polygraph procedure it is usual to keep the relevant questions down to perhaps several specific critical relevant questions and work strictly on those, and in this particular examination we had a large number of relevant questions to ask.

I think these are all factors that should be considered in the overall evaluation of Mr. Ruby's polygraph examination.

Mr. SPECTER. Thank you very much, Mr. Herndon. (81)



*FBI memoranda*

(22) Two FBI memoranda address the Bureau's interpretation of Ruby's polygraph. The first, dated July 20, 1964, (82) states that a preliminary review of the charts indicated that Ruby was not deceptive when denying that he knew Oswald or that he was involved in any conspiracy. The memo went on to note that this interpretation did not conflict with any of the FBI's prior investigations. The memo did caution, however, that if in fact Ruby had a "psychotic" personality, the test results should be considered inconclusive and not be relied on. The second memorandum, dated July 22, 1964, (83) repeated the same conclusion.

*The Warren Commission's conclusion*

(23) The Warren Commission stated in its report that it did not rely on the results of the Ruby polygraph examination in reaching its conclusions. (84) The commission noted that it had merely granted Ruby's request for such an examination. It published the transcript of the examination, as well as the transcript of the deposition of the FBI polygraph expert who administered the test.

*Selection of the panel*

(24) In August 1977, the committee decided to convene a panel of experts with no prior affiliation with the Kennedy (or the King) \* case to review the polygraph examination. Recommendations for panel membership were invited from Walter F. Atwood, executive director of the American Polygraph Association in 1976, and Charles R. Jones, vice president of the American Polygraph Association in 1978.

(25) They suggested nine people who were asked to provide resumes; additional information was sought later. Each was also asked to provide a list of the leading polygraphists.

(26) The committee interviewed 19 prospective panel members and chose 3:

(27) Richard O. Arther—B.S., with honors, in police science, Michigan State University, 1951; M.A. in psychology, Columbia University, 1960. Arther has been in private practice in New York City since 1953. He founded Scientific Lie Detection, Inc., cofounded the National Training Center of Polygraph Science. He has taught at Brooklyn College, Seton Hall University, the John Jay College of Criminal Justice, and the Graduate School of Public Administration of New York University. He has authored over 200 professional articles and two books. Arther is a member of the Academy of Certified Polygraphists and the American Polygraph Association.

(28) Charles R. Jones—B.S. in education (major in social science); completed National Training Center of Polygraph Science in 1959. Jones has been an instructor at the police training school in Charleston, W. Va., and currently teaches at the Zonn Institute of Polygraph, Inc., in Atlanta, Ga. He joined the Lincoln M. Zonn firm in 1961. Jones is a member of the American Polygraph Association and was elected vice president in 1976.

(29) Benjamin Frank Malinowski—retired Army warrant officer, with a career in criminal investigation and polygraph examinations.

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\*The same panel was to conduct an analysis of the James Earl Ray polygraph examinations.



He has been an instructor at the U.S. Army Military Police School, Fort Gordon, Ga. He attended the National Training Center of Polygraph Science in 1966. From 1967 to 1969 he was an operations officer with the Southern European Criminal Investigations task force. In 1975, he founded the Malinowski Polygraph Service. He is a member of the American Polygraph Association, and a former director of the Georgia Polygraph Association; twice president of the Georgia Polygraph Association; author of numerous articles on polygraph and criminal investigations, and formerly president of the Zonn Institute of Polygraph. He is also a nationally recognized speaker on polygraph and criminal investigations.

### *Examination procedures*

(30) On March 6, 1978, a letter was sent to each panel member informing him of the materials available relating to the Ruby polygraph. They were:

1. The original polygraph charts.
2. A stenographic transcript of the entire examination, including the pretest and posttest interviews.
3. Testimony of Dr. Beavers, given before the Warren Commission, concerning Ruby's medical condition at the time of the examination.
4. Testimony of FBI Special Agent Herndon, the FBI polygraph examiner, before the Warren Commission.
5. Expert medical testimony given at Ruby's trial.

(31) Each panel member was asked to review the list and inform the committee if they required all items or additional material. Each responded that the first four items were necessary and that the medical testimony at Ruby's trial would not be required. On May 19, 1978, copies of the materials other than the medical trial testimony were sent to each expert.

(32) The procedures were that: (1) Each polygraphist would conduct an independent examination of the materials; (2) the panel would then meet to discuss each member's findings; (3) a final joint panel report would be prepared and submitted to the select committee.

(33) The experts were asked to focus on the following major areas:

1. The circumstances surrounding the administration of the examination.
2. Any problems created by the medical condition, age, mental stability, et cetera, of the subject.
3. The procedure/technique used by the expert in administering the examination.
4. The analysis of the charts.

(34) The experts were told, however, that they should not feel confined by the above areas and should comment on any factor they considered relevant.

(35) On June 22, 1978, the three panelists and two committee staff members met at the Algonquin Hotel in New York City. The National Archives agreed to have the original charts taken to this meeting. At this time, the experts reviewed the original charts and discussed the polygraph examination. The panel was unanimous in its evaluation and agreed that Arther would be responsible for writing the panel's Ruby report, subject, of course, to the review and approval of the other two panel members. (85)

(36) The panel conducted its review using the state of polygraph technology in 1964. However, since the panel's review involved basic polygraph principles, the comments and conclusions are still timely.

#### REPORT OF THE POLYGRAPH PANEL

##### *Crucial factors affecting the examination*

(37) The panel noted the four factors mentioned by Herndon as having a detrimental effect on the examination: The time elapsed since the shooting; Ruby's extensive prior interrogation; the many people present during the examination; and the great number of relevant questions asked. (86)

(38) The panel believed these factors had a serious negative impact on the validity and reliability of the polygraph examination. Because Ruby had been extensively interrogated previously, Herndon should have been sure that the polygraph examination was very carefully conducted.

(39) When first approached by the Commission, Herndon immediately should have explained the polygraph's limitations. He should have refused to compromise the validity and reliability of the polygraph procedure by letting it become yet another interrogation of Ruby.

(40) Herndon himself considered the procedure to be more an interrogation than a polygraph examination, as seen in his testimony before the Commission with regard to test series 9:

Mr. HERNDON. Yes, there was at this point in the interrogation. Realizing the Commission had a large number of questions they wanted to ask, it was decided at this point, in view of the fact that we had asked the main critical questions, to proceed with what I call direct interrogation, that is that each and every one of the questions asked is a relevant question, and that there are no irrelevant questions or control questions asked. (87)

And again, discussing test series 9A, he testified:

Mr. HERNDON. This was done in order to save time inasmuch as the interrogation was becoming rather lengthy at this point, and Mr. Specter indicated he was anxious to proceed and to complete the rest of the questions that we had agreed upon with all those parties that were interested in this interrogation. (88)

(41) Note that in the above quotes Herndon uses the term "interrogation" four times, but not once does he use the term "polygraph examination." If the events of July 18 were considered an interrogation rather than a polygraph examination, the panel would be far less concerned with what it felt were gross abuses of basic polygraph principles. However, since Herndon rendered his opinions as a "polygraph examiner," the panel evaluated Ruby's charts as a polygraph examination.

(42) The panel was also very concerned about the number and movement of people in the examination room. During the pretest interviews, as many as 10 persons were present. Two left for the testing

phase, returning for the next pretest interview. Since there was a series of 13 pretests and then tests, such comings and goings certainly must have caused distractions.

(43) Herndon himself testified:

Mr. HERNDON. Normally during a polygraph examination the only ones in the room are the examinee and the examiner, and during Bureau proceedings we usually have another agent in the room out of sight that takes notes. It is considered an undesirable factor to have many people present in the room during a polygraph examination, particularly if these people are involved in any way in the case, such as the defendant's attorney or someone who has a personal and keen knowledge in the proceedings. In this particular instance, it appeared to me that Mr. Ruby divorced the presence of these people from his mind during his response to the questions. However, it should be considered a factor which is one that could tend to negate a valid conclusion with regard to chart interpretation. (89)

(44) The panel believes the presence of eight persons in the examination room seriously impaired the examination. Any momentary distraction during the examination could cause the examinee to react, thereby recording a "lie" reaction on the polygraph chart. Herndon could well think this reaction was a true reaction to a lie, especially when reviewing the charts at a later time. Further, the panel found that Herndon never repeated a relevant question. The possibility of uncorroborated reactions which are false becomes very crucial in the evaluation of the Ruby polygraph examination.

(45) Herndon should have insisted, long before the date of the examination, that the standard procedure be followed whereby only the polygraphist and the person are in the room. If others had a need to observe the examination, then a room with a one-way mirror, a sound system, and perhaps a recording device could have been used—all standard procedures since the 1930's. A recorder might also have eliminated the need for the presence of a reporter in the examination room. A recorder generally provides a more accurate record. The Dallas Police Department had available a specially prepared and equipped room which would have allowed for a much more professional and conducive atmosphere. (90)

(46) A third factor the panel finds impaired the Ruby polygraph examination concerned the number of relevant test questions asked. The panel members believe it showed total disregard of basic polygraph principles.

(47) The crux of every polygraph examination is the number of test questions and how they are worded. When the Ruby examination was conducted, the primary textbook on the subject was "Lie Detection and Criminal Interrogation," by Fred E. Inbau and John E. Reid (3d ed., 1953). This book recommends three relevant questions, since the more a person is tested, the less he tends to react when lying. That is, sooner or later, liars become so "test-tired," they no longer produce significant physiological reactions when lying. One panel member, Arther, said that in his 27 years of experience he had never heard of



a polygraph examination with more than 17 relevant questions. Yet, in the Ruby examination, Herndon asks some 55 relevant questions. As Herndon himself stated:

In normal polygraph procedure it is usual to keep the relevant questions down to perhaps several specific critical relevant questions and work strictly on those. (91)

(48) Further, the panel could see no need for the vast majority of the relevant questions. It considered most to be trivial in comparison with the major issues on which Herndon should have concentrated. For example, the following trivial and poorly worded relevant questions were asked:

1. Did you get a Wall Street Journal at the Southwestern Drug Store during the week before the assassination?
2. Did you go to the Dallas police station at any time on Friday, November 22, 1963, before you went to the synagogue?
3. Did any close friend or any member of your immediate family ever attend a meeting of any group that advocates the violent overthrow of the Government? (92)

(49) The panel concludes that Herndon should have insisted that the total number of issues covered be reduced to no more than four. The panel suggested, for example, that only the following four relevant test questions should have been asked to cover the critical issues (Herndon did ask questions similar to three of the areas):

Before last November 22, did you ever hear the name of Lee Harvey Oswald?

Did you murder Oswald to silence him?

Did anyone instruct you to murder Oswald?

Did you ever talk with Lee Harvey Oswald? (93)

### *Loss of control*

(50) Numerous instances in the transcript of the Ruby polygraph examination indicate that Herndon completely lost control over the examination. The problem most often stemmed from the ad hoc participation of the observers in the conduct of the polygraph examination. (Of course, the panel found the number of observers itself to be detrimental to the examination.)

(51) As an example, the standard pretest procedure is to ask the person each question and allow for discussion and a response. This is done before any of the components are attached to the examinee. Herndon stated his intention to proceed in this manner, but upon objection from Ruby's attorney, Clayton Fowler, Herndon acquiesced, abandoning this most important aspect of the pretesting phase and disregarding an important polygraph principle. The applicable part of the transcript follows:

MR. HERNDON. In other words. I am going to tell you what the question is going to be and you shall feel free to answer it "yes" or "no."

MR. FOWLER. Excuse me, sir.

MR. HERNDON. Certainly.

MR. FOWLER. At this time, Jack, I request that in view of the fact that you're not hooked up, that you do not answer the



question and reserve those until such time as you will be on the machine.

Mr. RUBY. That's fine.

Mr. HERNDON. Then, we will just discuss the questions.

Mr. RUBY. Do it to your advantage, may I add.

Mr. HERNDON. I generally prefer in my practice with the polygraph to have the gentleman answer the question so that he knows he has already answered it, and as a matter of record, he knows that that question is coming along.

Mr. RUBY. Please let me do it, will you? [Addressing Mr. Fowler.]

Mr. FOWLER. [No response.]

Mr. HERNDON. I will bow to whatever Mr. Specter or counsel wants to do in this regard.

Mr. RUBY. Fowler, I hate to dispute with you, but let me do it this way?

Mr. FOWLER. Well, Jack, again, Mr. Alexander is here and again I tell you this—that the answers to some of these questions could be absolutely very detrimental to you.

Mr. RUBY. They can't be.

Mr. FOWLER. I'm talking about from a legal standpoint. Now, morally, I know how you feel and you want to do the best you can for the commission.

Mr. RUBY. I will.

Mr. FOWLER. But by the same token, this gentleman over here [referring to Mr. Alexander] represents the State, who at this time is not representing you. Now, if we could allow Mr. Alexander to have the benefit of the nature of the questions, with the exception of the answers—if this is what Jack wants—but I do not want Mr. Alexander to have the benefit of the answers.

Mr. SPECTER. The test may be conducted either way. As Mr. Herndon has explained, he has a slight preference to have the answers, but the ultimate decision on that is up to Mr. Ruby and his counsel. The commission will proceed in either manner.

Mr. RUBY. It's unfortunate that my attorney, Mr. Fowler, don't see as I do. I would like to give every cooperation without the slightest fraction of interference. That's why I requested that. You won't let me do it that way, huh, Fowler?

Mr. FOWLER. I'm requesting that you do not, Jack.

Mr. HERNDON. It will be no problem. (94)

(52) Other examples of Herndon's loss of control abound. For example, on one page of the transcript he makes only two short statements; (95) at another point, a discussion by the observers about one question occupies almost six pages and includes an argument between Ruby and his attorney, Fowler, about who should be present in the room. (96) At other points, Ruby is reminded by Fowler that he could be convicted of first-degree murder by telling the truth and that he should not even be taking the polygraph examination. And at still another point, Herndon seeks the advice of Warren Commission attorney Specter about the phrasing of a question. (97)

(53) A good example of an objectionable result that occurred because of Herndon's loss of control takes place as follows. Just before test series No. 4, Ruby's responses were very erratic. He appeared to have "gone to pieces." Herndon later attributed this to fatigue, citing this as "the first series where Mr. Ruby tends to show a little fatigue." (98)

(54) However, just before that series had started, Ruby had had a private conversation from 4:13 to 4:15 with another of his attorneys, (99) whom Ruby previously had not wanted in the examination room, as shown by this:

Mr. RUBY. Did you get your pants sewed up, Joe?

Mr. TONAHILL. It went through to my leg.

Mr. RUBY. That was a pretty rough brawl we had, wasn't it, Joe?

Mr. TONAHILL. Yes.

Mr. RUBY. Joe, I'd appreciate it if you weren't in the room. Can I ask you to leave, Joe?

Mr. TONAHILL. I'll be glad to leave, if you want me to, Jack.

Mr. RUBY. As a matter of fact, I prefer Bill Alexander to you, you're supposed to be my friend.

Mr. TONAHILL. Let the record show that Mr. Ruby says he prefers Bill Alexander being here during this investigation, who is the assistant district attorney who asked that a jury give him the death sentence, to myself, who asked the jury to acquit him, his attorney. (100)

(55) Ruby then had two off-the-record conversations with Alexander—from 4:15 to 4:18 and from 4:22 to 4:25, (101) followed by still another extremely long argument as to the wording of just one test question, with five people taking part in the discussion: (102) "Were you in the Dallas Police Department jail at the time Lieutenant Pierce's car drove out of the basement?" (103)

(56) The panel questioned Herndon's conclusion that it really was fatigue that caused Ruby to "go to pieces" on this particular test, believing it might have been due either to something said during the three private conversations or to the argument over the wording of that one question. Perhaps it simply was the chaotic nature of the entire situation.

(57) The panel believed that the participation of the observers and the various asides never should have been allowed by Herndon. The panel concluded that Ruby was probably distracted, both mentally and physically, making a difficult examination even more difficult to conduct successfully.

#### *Other factors*

(58) In addition to the factors discussed above which impaired the Ruby polygraph examination, the panel concluded that 10 additional factors, of perhaps less importance, further reduced the validity and reliability of the examination. These are as follows:

(59) 1. It is generally agreed that the best time to examine is in the morning, because then the great majority of persons are both physically and mentally "fresh." As the day progresses, a person normally tires. Since the polygraph mainly records physical change induced by mental stimulation, a tired person does not react to stimulation as well

as a rested person does. Although Ruby most likely was a night-oriented person as a result of his occupation as a nightclub owner, by July 18, 1964, normal prison routine no doubt had changed his orientation. The panel therefore concluded that the examination should have started early in the day, perhaps around 8 a.m. As it was, the examination started at 2:23 p.m., with the first test beginning at 3:10 p.m. (104)

(60) 2. When administering an extremely difficult examination, most experts advocate reexamination on a later date to check the reliability of the first examination, that is, will the same reactions be obtained on the reexamination? Ruby was never given a second polygraph examination, nor is there any indication that one was ever considered. After reviewing the charts, each panel member believed strongly that a reexamination was absolutely essential for at least three reasons:

(61) a. It is a basic and commonly accepted polygraph procedure.

(62) b. Herndon did not repeat relevant questions, thereby providing no possible corroboration of the results.

(63) c. All of the adverse factors working against the orderly conduct of the examination made the results of the examination suspect, at best.

(64) 3. The panel concluded that the polygraph instrument was either improperly adjusted, or defective, or both. It made three tracings, two of which are so totally inadequate that they appear to be defective. The breathing tracing is particularly poor, either because the sensitivity was maladjusted or possibly because the pneumograph tube was not properly placed on Ruby. The amplitude of the breathing tracing is not even minimally acceptable in any of the 13 tests. The panel found this to be a constant handicap in analyzing this extremely important tracing and interpreting the charts. Sufficient amplitude is critical because the polygraphist looks for changes in the breathing pattern. Often such changes are minute and simply do not appear when the amplitude is small to begin with.

(65) The panel found the galvanic skin response (GSR) tracing to be of minimal help in analyzing Ruby's charts. The main problem with the GSR in the first session (before the break) is a lack of sensitivity due to Herndon's setting the sensitivity at one-fourth of maximum. He decreased it to one-fifth for the third series of questions. The panel noted that it should have been tried at a maximum sensitivity prior to the first test, where probably it should have remained for the entire examination. Had the sensitivity been higher, the polygraph probably would have produced an adequate tracing, that is, one that the panel could analyze.

(66) The panel could provide no explanation for why Herndon decreased the sensitivity for the third series. In fact, generally recognized principles in 1964 called for the sensitivity to be continually increased.

(67) After the break, the examination commenced with series 5 through 11, with the sensitivity set at one-fifth of maximum.

(68) The panel concluded that during this entire session, the GSR was completely defective. At best the polygraph appeared to be in extremely poor condition. In an examination of this importance, a back-up polygraph should have been available and, in the panel's view, should have been used. The examination should have been stopped until another polygraph could be obtained.



(69) 4. Herndon's definition of a "control" question goes far beyond the generally recognized definition, as discussed in the leading book of the day by Inbau and Reid. The "control" question, developed by Reid in 1943, is one similar but unrelated to the crime being investigated to which the expert knows the correct answer and to which the person will probably lie. If the person's reaction to a properly worded control is more pronounced than to the relevant questions, he is considered to be truthful. On the other hand, if his reaction to the relevant questions is more pronounced, he is considered to be lying to the relevant questions.

(70) If the control questions are properly worded, it is very possible that a person lying to the relevant questions will appear to be truthful.

(71) Herndon's control questions were not correctly worded. He defined a "control" question as one to which the person will have some emotional response. (105) Thus, he used such controls as:

1. Have you ever been arrested? (106)
2. Are you married? (107)
3. While in the service did you receive any disciplinary action? (108)
4. Have you served time in jail? (109)
5. Did you attend the synagogue regularly? (110)

(72) It is obvious that not one of the above questions is a control, as defined by Inbau and Reid. For example, to the question, "have you ever been arrested?", Ruby answered "yes." Therefore, it is not a lie, yet Herndon considered it to be a control question. (111)

(73) Further, Herndon violated a basic rule that surprise questions should never be used as controls. For example, while asking a series, he says, during the test, "have you ever been known by another name? Don't answer that question. Skip it. Just sit and relax." (112)

(74) Such talk by the expert should automatically prevent this question from being used in the chart analysis. Yet Herndon uses it as a control. He testified: "The only significant change physiologically during series No. 2 was in Mr. Ruby's response to the question, 'Have you ever been known by another name?,' portrayed by an increase in his blood pressure." (113)

(75) Such a procedure can easily lead to a mistake, particularly in indicating a liar to be truthful. In fact, if one wants to generate a truthful response on the chart when testing a liar, one could ask a surprise question, then immediately give extensive instruction regarding it, and thereafter evaluate it as a control question. In such a situation, at least 95 percent of the liars will give a more intense physiological reaction than they will to the relevant question to which they are lying.

(76) 5. What Herndon considers to be irrelevant questions often do not meet the criteria for an irrelevant question. The generally accepted definition of an irrelevant question is a meaningless, nonemotional question which the polygraphist knows the person will answer truthfully, e.g., "Do you live in the United States", or "Right now are you in Texas?"

(77) It was difficult for the panel to determine if Herndon considered certain questions to be irrelevant or controls. In fact, he himself confused their distinction. For example, question 4 in series 3 is officially listed as an irrelevant ("Are you married?"), yet Herndon used it as one of his control questions. (114)



(78) Following are several examples of irrelevant questions, as indicated on Herndon's question sheets, which the panel concluded were improperly classified. The panel found these questions to be more relevant, at times, to the important issues than the questions Herndon had listed as relevant.

1. Is your last name Ruby? (Originally his name was Rubenstein, and Herndon asked this question even after being told that Ruby changed his name from Rubinstein.) (115)
2. Did you take any medication this morning?
3. Have you answered these questions truthfully?
4. Are your parents alive? (Both are dead, and after his father died Ruby went to the synagogue "consistently for 11 months, morning and evening.") (116)
5. Are you tired?
6. Do you intend to answer the questions truthfully?
7. Were you at one time employed by a union? (There was also a relevant question, "Did you shoot Oswald because of labor union influence?") (117)

(79) 6. Is everything you told the Warren Commission the entire truth? It is customary to repeat every question at least on a second test. This is done in order to establish the consistency (reliability) of the polygraph reactions. This was not done in the Ruby examination. Therefore, there was no way for Herndon to establish the reliability of the relevant questions.

(80) Hence, the possibility that a "lie reaction" to a control was caused by something other than a lie remains an open issue. This is particularly important because there were so many possible distractions in the examination room.

(81) 7. Between tests, a polygraphist should not tell a person if the tracings indicate truthful or lying responses to the relevant questions. This is particularly important in case a liar has some method of "beating the lie detector." If he believes he is coming across as truthful, he is reassured that his method is working. Thus, he will feel less uneasy when he lies, producing less dramatic reactions.

(82) In spite of this, after completing the first series, Herndon told Ruby: "Mr. Ruby, there are two questions I want to ask you about on our first series." At this point he discussed only the questions having to do with Ruby's middle name and the question having to do with whether Ruby had ever been arrested. Herndon did not mention the relevant questions, which could easily have led Ruby to believe that he had "passed" the test in regard to the relevant questions. (118)

(83) Herndon finished the discussion of series 1 with the comment: "Mr. Ruby, you are now a veteran of the first series. You did real well. You cooperated very fine." (119)

(84) Such statements could easily be interpreted by Ruby as meaning that he seemed to be truthful (to the relevant questions), especially when Herndon stated, "You did real well."

(85) If Ruby had lied on the first test, he would have had good reason to believe he had beaten the polygraph. Such knowledge certainly would have reduced his fear of lying, hence his lying reactions would have been reduced in subsequent questioning.

(86) And again, just as the first series is ending (prior to the break at 4:45 after series 4), Herndon stated: "You've done very well thus far, Mr. Ruby, as far as cooperating on the examination." (120)

(87) 8. A great deal of thought and preparation is necessary to conduct a quality polygraph examination. When a case is complicated or the examination conditions adverse, more preexamination preparation is necessary.

(88) In the panel's opinion, Herndon appeared largely unprepared to conduct the Ruby examination. Herndon testified that he knew the issues the Warren Commission wanted covered. (121) However, it appeared that all questions were not prepared in written form before the day of the examination. For example, as the first phase of the examination was being completed, Herndon said: "We will have to prepare some more questions." Specter: "May the record show that Mr. Alexander and Mr. Tonahill are now back in the room, and we are going to take a brief recess." (122) The "brief recess" lasted 1 hour and 40 minutes, during which time Ruby apparently was left in the examination room. (123)

(89) 9. The panel concluded that Herndon often used techniques in conducting the polygraph examination which did not conform to generally recognized principles of polygraphy. An example is test series 3A, which apparently was a "searching peak-of-tension test." A searching peak-of-tension test usually contains six or seven logical questions on the same issue. The polygraphist does not know which one is actually true. It is hoped that the liar will give a lying reaction to the appropriate question, thus permitting the expert to learn information not previously known. This test is usually given to locate loot and/or weapons, learn the names of accomplices, determine the amount of money embezzled, et cetera.

(90) The panel found the wording of the basic question in this series—"When did you first decide to shoot Oswald?"—to be very poor. This question ignored the possibility that Ruby might have been ordered to murder Oswald. The panel also found other choices to be poor. For example, the possibility that Ruby may have decided to shoot Oswald on the previous Friday night or the next Saturday afternoon were not even asked.

(91) 10. It is generally agreed that the more a person is tested, the less responsive he becomes. If a liar is tested enough times, sooner or later, his reaction to lies will be no more intense than to control and relevant questions. He therefore will appear truthful when lying. For this reason, the great majority of the recognized polygraph techniques limit the number of test groups to five or less, with no more than two different series of questions. Most call for the entire examination to be concluded within 2 hours. Panel member Richard Arther, for example, uses just one series of four relevant questions, asked in three separate test groups.

(92) The Ruby examination consisted of 13 groups of questions, with the actual examination starting at 2:23 p.m. (124) and ending at 8:59 p.m. (125) Even though there supposedly was a break of 100 minutes, the testing should never have been resumed that day.

(93) Herndon himself recognized this:

Mr. SPECTER. Is there any overall limitation on the amount of time that a person can appropriately take a polygraph examination?

Mr. HERNDON. Yes; there is a limitation. Certainly if a person is interviewed with polygraph at great length, in

due time he is bound to become desensitized to the technique. In other words, the pressure on his arm and the technique itself becomes less valid as the increase in time proceeds.

Mr. SPECTER. Did Mr. Ruby ever become desensitized to the technique?

Mr. HERNDON. I believe in the last series of the first session, which I believe is series 4, Mr. Ruby showed some indications of becoming fatigued and displayed some tiredness in the charts. Also, I might add in the later phase of the examination, in the latter series, there was some indication that he was approaching this desensitization that I have mentioned before. (126)

(94) The panel concluded that the Ruby examination was far too long.

### *Chart analysis*

(95) The panel concluded that the Ruby polygraph examination was probably invalid and unreliable. As discussed above, the panel found serious flaws in the examination procedures. The questions were especially poorly worded. The polygraph instrument itself was either incorrectly adjusted or defective in its operation. The panel could render no opinion regarding the examination results.

(96) Of the 13 test groups, the first and second are perhaps the most valid in that they were conducted when Ruby was still "fresh." Because of the importance of the relevant questions in these two tests, the panel has briefly summarized its opinion about them.

(97) The relevant questions on the first series and Ruby's answers were:

1. Did you know Oswald before November 22, 1963?

Answer. No.

2. Did you assist Oswald in the assassination?

Answer. No.

(98) Herndon concluded from his analysis of the charts that Ruby was truthful in answering these two relevant questions. He arrived at this conclusion by comparing Ruby's response to the control question (Have you ever been arrested? Answer: Yes.).

(99) As previously noted, the panel believed this to be an extremely poor control question.

(100) Herndon testified that Ruby's physiological response to this control question was recorded on the charts in terms of a "noticeable rise in his blood pressure." (127) The panel took issue with this conclusion because the rise in blood pressure occurred at least 7 seconds after Ruby answered. A response normally never occurs this long after the question. The typical reaction, would be in 1 or 2 seconds. Further, the panel noted that at the point of the rise in blood pressure, Herndon indicated on the chart (as "MF") that Ruby moved his feet. The panel believed that the rise in blood pressure most likely was caused by Ruby's movement and not his physiological reaction to the "control" question. This conclusion is corroborated by the fact that Ruby's breathing remained relaxed at the time of the rise in blood pressure, and the Galvanic skin response showed no reaction.

(101) In fact, the reactions to the preceding question—(Did you assist Oswald in the assassination?)—showed the largest valid GSR reaction in test series No. 1. In addition, there is a constant suppress-



sion of breathing and a rise in blood pressure at the time of this crucial relevant question. From this test, it appeared to the panel that Ruby was possibly lying when answering "no" to the question, "Did you assist Oswald in the assassination?" This is contrary to Herndon's opinion that Ruby was truthful when answering that question. (102) The relevant questions on the second series and Ruby's answers were:

1. Are you now a member of the Communist Party?

Answer. No.

2. Have you ever been a member of the Communist Party?

Answer. No.

(103) Herndon concluded that Ruby was truthful when answering these two questions. He testified that the only significant physiological change noted occurred in response to the question, "Have you ever been known by another name?" The response identified by Herndon was a rise in blood pressure. (128) However, Herndon stated that Ruby later said he was confused on how to answer the question because he had changed his name from Jack Rubenstein years before. Herndon testified that other variations in the breathing tracing were caused by Ruby's hesitating to answer some questions due to their length. (129)

(104) The panel noted that according to the transcript of the examination, Ruby did not answer the question about his having another name. Herndon told him not to answer because they had not reviewed it during the pretesting phase. (130) The panel concluded that Ruby's reaction was simply a false reaction to Herndon's unorthodox instruction after he asked the question. On the other hand, the panel noted a large rise in blood pressure in response to the question, "Have you ever been a member of the Communist Party?", to which Ruby answered, "no."

(105) This question also evoked by far the most dramatic breathing reaction. Although Herndon claimed that the only variation in breathing in this series is caused by the length of the questions, this was certainly a short question, and it is much more likely he was referring to other questions. (131)

(106) In fact, in regard to the question, "Are you a member of the Communist Party?", Herndon stated, "there was no significant physiological change." (132) However, Herndon himself apparently wrote on the chart on this question, "slight suppression," which indicates a specific emotional change and one which is an excellent indicator of lying.

(107) It is interesting to note that during the entire first testing session this is the only place where Herndon wrote on the chart anything having to do with the breathing, except on series 4, when he wrote as a general comment, "Breathing irregular."

(108) In summary, the panel strongly disagreed with Herndon's opinions, and specifically with series 1 and 2, as discussed above. The panel concluded that the "lie" reactions on these two tests occurred on questions different from those suggested by Herndon. Based on its analysis of the charts themselves, and not considering the negative factors affecting the veracity of the examination, the panel could not form an opinion that Ruby told the truth when answering "No" to the four relevant questions asked on test series 1 and 2. On the contrary, the panel found more indication that Ruby was lying in response to these four questions.



(109) It is emphasized by the panel, however, that no opinion could be rendered on the validity of this examination or the reliability of the results for the numerous reasons discussed in this report.

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- (4) Warren Report, p. 807.
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- (7) FBI teletype, to director from Dallas, July 15, 1964, file No. 44-24016-1762; letter from Hoover to Rankin, July 16, 1964, FBI file No. 44-24016-1765; FBI teletype, to director from Dallas, July 25, 1964, FBI file No. 44-24016-1797; Warren Report, p. 808.
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- (81) Ibid.
- (82) FBI memorandum, to Conrad from Jones, July 20, 1964, file No. 44-24016-1807.
- (83) FBI memorandum, to Conrad from Jones, July 22, 1964, file No. 44-24016-1827.
- (84) Warren Commission Report, p. 816.
- (85) HSCA Outside Contract Report, June 22, 1978, JFK Document No. 006748.
- (86) Warren Commission hearings, vol. 14, p. 598.
- (87) Id. at 595.
- (88) Ibid.
- (89) Id. at 583.
- (90) In July 1964, Paul Bentley was the chief polygraphist, Dallas Police Department. During the summer of 1978, Bentley confirmed to panel member Arther that his properly equipped room would have been made available had anyone requested it for Ruby's examination.
- (91) Warren Report at 598.
- (92) Id. at 551-556.
- (93) Id. at 559-561, inter alia.
- (94) Id. at 518.
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# THE EXAMINATION OF THE HANDWRITING AND FINGERPRINT EVIDENCE

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Report to the  
Select Committee on Assassinations  
U.S. House of Representatives  
Ninety-fifth Congress  
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## INTRODUCTION\*

(1) Several critics of the Warren Commission have speculated that there were two Lee Harvey Oswalds. Two versions of this theory have been put forward. One is that the real Lee Harvey Oswald never returned from the Soviet Union; instead, an imposter was sent on a sinister mission. The second is that others, for whatever purposes, used Oswald's name.

(2) One of the first proponents of the two-Oswald theory was a philosophy professor named Richard Popkin, who in 1966 published a book entitled "The Second Oswald." (1) Popkin cited the numerous instances recounted in the Warren Commission report in which people claimed to have seen or dealt with Oswald under odd or suggestive circumstances. Examples included Oswald being seen at a rifle range, (2) driving a car, (3) and in the company of two Latin-looking men seeking financing for illegal activities from Mrs. Sylvia Odio (a Cuban refugee leader in Dallas). (4) Popkin concluded that the cases of apparent duplication could plausibly be interpreted as evidence that Oswald was involved in a conspiracy, culminating in the events of November 22, 1963. (5)

(3) Sylvia Meagher, in "Accessories After the Fact," also criticized the Commission for not seriously considering the two Oswald possibility, "\* \* \* much less evaluate[ing] the evidence for or against such an explanation." (6)

(4) The Warren Commission discounted the incidents, principally on grounds that they had occurred when it was concluded that Oswald was elsewhere—in Mexico at the time of the rifle practice, (7) en route to Mexico at the time of the Odio meeting. (8) It dismissed other incidents because they involved activities in which Oswald apparently did not engage, such as driving. (9)

### *The committee's approach*

(5) In an effort to resolve the two-Oswald issue, the committee decided to convene a panel of experts to examine samples of handwriting attributed to Oswald. These samples were taken from numerous documents purportedly written and signed by Oswald in the last 7 years of his life. They were organized according to five significant periods: (1) October 1959 through September 1959, when Oswald was in the Marines; (2) October 1959 through June 1962, when Oswald was in the Soviet Union; (3) July 1962 to September 1963, when Oswald lived in Dallas and then in New Orleans; (4) the final week of September 1963, when Oswald visited Mexico; and (5) from the end of September 1963 to the day of the assassination, when Oswald lived in Dallas. The panel was to determine if the handwriting on the documents was that of one person.

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\*Materials submitted for this report by the committee's questioned documents panel were compiled by HSCA staff members G. Robert Blakey and Whitney Watriss.

(6) The committee also decided to retain another expert to verify, independently, that one or more of Oswald's signatures was in fact his. To make such a determination, the committee sought all fingerprint cards which Oswald had signed. Three were found in the FBI records, two of which were signed: One, dated October 24, 1956, was from Oswald's induction into the Marines; the second, of August 9, 1963, was from his arrest in New Orleans; and the third, unsigned, was dated November 22, 1963, the day of his arrest after the assassination. The expert was to determine if the fingerprints were all Oswald's, which would verify the signatures as Oswald's.

(7) The committee reasoned that if these determinations could be made, the two-Oswald theory would be far less plausible. If not, it would be more authoritatively established.

(8) This approach of the committee was substantially different from that of the Warren Commission. The Commission had used the documents for evidentiary purposes, for example, to determine if Oswald had used the alias "Hidell" or to link Oswald with the purchase of the Mannlicher-Carcano rifle. It had accepted as fact that certain of the documents had actually been signed or written by Oswald and compared these with "unknown" documents to establish evidentiary links.

(9) The committee, on the other hand, did not assume that any of the documents were written by Oswald. Instead, it sought to prove that one or more signatures were positively Oswald's and that all the documents had been written by the same person.

#### *Selection of the experts*

(10) The committee asked the president of the American Society of Questioned Document Examiners for recommendations on the leading experts in the field of questioned document examination, specifically handwritten documents. The committee then asked each of the people he recommended for their suggestions. Three names appeared consistently. After ascertaining that none had had a prior connection with the FBI or the Kennedy case, the committee requested that they undertake an examination of various documents. The panel members, all of whom belong to the American Society of Questioned Document Examiners, were Joseph P. McNally, David J. Purtell, and Charles C. Scott.

(11) McNally received a B.S. and an M.P.A. in police science from the John Jay College of Criminal Justice, University of New York City in 1967 and 1975 respectively. He started in the field of questioned document identification in 1942 with the New York Police laboratory. He has been supervisor of the document identification section of the police laboratory, training officer in the police academy, commanding officer of the police laboratory, and handwriting expert in the district attorney's office of New York County. He retired from the police department with the rank of captain in 1972 and entered private practice. He serves as a consultant to New York's Human Resources Administration.

(12) McNally is a fellow of the American Academy of Forensic Sciences, and a member of the International Association for Identification, and the American Society for Testing and Materials. He has lectured at the University of New York City, Rockland College, and the New York Police Academy.



(13) Purtell received a Ph.B., with a major in mathematics and chemistry, from Northwestern University in 1949. He began his career in questioned document identification in 1942 with the Chicago Police Department, where he served as document examiner in the scientific crime detection laboratory. He retired in 1974 as chief document examiner and captain of police, and entered private practice in 1973.

(14) Purtell is a fellow of the American Academy of Forensic Sciences and served as chairman of the questioned document section and chairman of the program committee. He is a past vice president and president of the American Society of Questioned Document Examiners. Purtell has lectured at Northwestern University, the University of Illinois, the University of Indiana and St. Joseph's College, among other schools. He has presented and published numerous scientific papers.

(15) Scott received an A.A. degree from Kansas City Junior College in 1930 and a J. D. from the University of Missouri School of Law in 1935, whereupon he became a member of the Missouri bar. While attending law school, he founded the University of Missouri at Kansas City Law Review and was its first editor-in-chief. He began his career as a questioned document examiner with the Federal Reserve Bank in 1935 and has been in private practice since 1946. The first edition of his three-volume book, "Photographic Evidence," was published in 1942. Now in its second edition, it has become the standard textbook on the subject.

(16) Scott served on the first board of directors of the American Board of Forensic Document Examiners. He has conducted seminars on scientific document examination for more than 20 State bar associations, written numerous professional articles, and, since 1954, has been an adjunct professor of law at the University of Missouri School of Law.

(17) The expert selected for the print—finger and palm—analysis was Vincent J. Scalice, president of Forensic Control Systems, Inc., of New York City.

(18) Scalice, before entering private practice, served with the New York City Police Department from 1956 to 1977, where he attained the rank of detective first grade. He has been a lecturer and instructor on crime scene examination and latent print identification at the New York City Police Academy, a lecturer on fingerprint identification and courtroom technique at Brooklyn Law School, and he formulated and taught a course on crime scene examination for the detective division of the New York City Police Department.

#### *Issues addressed by the experts*

(19) The committee asked McNally, Purtell, and Scott to address four issues:

1. Were the signatures "Lee Harvey Oswald" and "Lee H. Oswald" on the various documents written by the same person?
2. Was the script writing on the various documents, which was purported to be Oswald's, done by the same person?
3. Was the Russian writing on the various documents, which was purported to be Oswald's, done by the same person?
4. Was the "historical diary" written in one sitting?

(20) Subsequently, the committee asked Purtell and McNally to look at whether the signature "A. J. Hidell" on the June 15, 1963, Fair Play for Cuba card was written by Marina Oswald. In addition, McNally was asked to determine whether the signature "Jack Ruby" on the undated Cuban identification card had been written by Jack Ruby.

(21) Scalice was asked to verify that the finger and palm prints which appeared on the three cards were of the same person. Subsequently, he was asked to examine some other documents.

### *Evidence examined*

(22) *Handwriting.*—The committee gathered some 50 documents to be examined.\* Following is a list and description of those items.

1. October 24, 1956. Original of U.S. Marine Corps enlistment contract and record, service No. 1653230, signed Lee Harvey Oswald. Blue ink; nib pen. Location: Department of Defense (hereinafter DOD). (JFK exhibit F-479.)\*\*
2. October 24, 1956. Carbon of item 1, with an original signature, Lee Harvey Oswald. Blue ink; nib pen. Location: DOD (JFK exhibit F-479a.)
3. October 24, 1956. Loyalty certificate for personnel of the Armed Forces, signed Lee Harvey Oswald. Blue ink; nib pen. Location: DOD. (JFK exhibit F-481.)
4. October 24, 1956. U.S. Marine Corps examination of applicant by recruiting officer, signed Lee Harvey Oswald. Blue ink; nib pen. Location: DOD. (JFK exhibit F-480.)
5. October 24, 1956. U.S. Marine Corps record of emergency data, signed Lee Harvey Oswald. Blue ink; nib pen. Location: DOD. (JFK exhibit F-478.)
6. October 24, 1956. Armed Forces fingerprint identification card, numbered 327 925 D, signed Lee Harvey Oswald. Blue ink; ballpoint pen. Location: Federal Bureau of Investigation (hereinafter FBI). (JFK exhibit F-482.)
7. October 25, 1956. U.S. Marine Corps miscellaneous information and index form (NAVMC 118(1)-PD), signed Lee H. Oswald. Blue-black ink; nib pen. This document bears a second signature, reading Lee H. Oswald, dated October 28, 1956, blue-black ink, nib pen; and a third signature, reading Lee H. Oswald, dated May 2, 1957, black ink, nib pen. Location: DOD. (JFK exhibit F-483.)
8. May 8, 1958. Identification card, U.S. Forces, Japan, signed Lee H. Oswald. Location: National Archives (hereinafter Archives). Found in Oswald's wallet on the day of his arrest. (FBI exhibit D-225: B 1-9; JFK exhibit F-505.)
9. September 10, 1959. U.S. passport No. 1733242, signed Lee H. Oswald. Faded blue ink; ballpoint pen. Location: Archives. (Warren Commission exhibit 946, hereinafter CE 946; JFK exhibit F-486.)

\*The items listed here number 63; the difference in numbers is due to examination of more than one copy of an item, that is, an original and a photo reproduction.

\*\*Copies of most of the documents appear at the end of this report. Numbers 53 and 61 were not available, but are contained in committee files at the Archives.

10. September 10, 1959. Photograph of passport bearer of U.S. passport No. 1733242, appearing on page 4, signed Lee H. Oswald, and photograph of "Baby Lee Oswald," on page 14, signed June Lee Oswald, father. Black ink; ballpoint pen. Location: Archives. (CE 946; JFK exhibit F-486.)
11. September 11, 1959. U.S. Marine Corps notice of obligated service, signed Lee Harvey Oswald. Blue ink; ballpoint pen. Location: Archives. (JFK exhibit F-485.)
12. September 11, 1959. U.S. Marine Corps security termination statement and index, signed Lee Harvey Oswald. Blue ink; ballpoint pen. Location: DOD. (JFK exhibit F-484.)
13. September 11, 1959. Carbon copy of Armed Forces of the U.S. report of transfer or discharge, signed Lee Harvey Oswald, with a carbon copy signature. Location: DOD. (FBI exhibit D-18.)
14. September 14, 1959. Selective Service System registration card, signed Lee H. Oswald. Black ink; ballpoint pen. Location: Archives. (JFK exhibit F-487.)
15. September 14, 1959. Selective Service System registration certificate, signed Lee H. Oswald. Black ink; ballpoint pen. Location: Archives. (JFK exhibit F-505.)
16. October 16, 1959 to March 27, 1962. Historical diary, 12 handwritten pages. (Only p. 11, dated July 15, 1961 to January 4, 1962, was examined, as all other pages were badly stained with fingerprint developer and are entirely unsuitable for handwriting examination.) Location: Archives. (CE 24; JFK exhibit F-491.)
17. November 3, 1959. Declaration requesting revocation of U.S. citizenship, signed Lee Harvey Oswald. Purple ink; nib pen. Location: Archives. (CE 244; JFK exhibit F-488.)
18. November 15, 1959. Photocopy of handwritten account of interview with Miss Aline Mosby, UPI reporter. Unsigned. (The original of this document was also submitted but could not be examined because it was completely covered and stained with fingerprint developer.) Location: Archives. (CE 2717; JFK exhibit F-489.)
19. 1960, undated. Political discussion, handwritten on stationery of the Holland-American Line; 15 pages. Blue ink; nib pen. Location: Archives. (FBI exhibits 123 and 124; CE 25; JFK exhibit F-490.)
20. 1962, undated. Self-questionnaire. Location: Archives. (FBI exhibit 116; CE 100 and part of 24.)
21. 1962, undated. Photocopy of document identified as a self-questionnaire. Original was stained and unsuitable for examination. Location: Archives. (JFK exhibit F-402.)
22. January 17, 1962. Affidavit of support, addressed to the American Embassy, Moscow, U.S.S.R., signed Lee H. Oswald. Blue ink; nib pen. Location: Archives. (CE 775; JFK exhibit F-492.)
23. February 20 (1962). Russian script on lined paper, from "Alek" to "Marina" and "June." Location: Archives. (FBI exhibit 134; CE 59; JFK exhibit F-493.)
24. March 24, 1962. Entry papers of Marina Oswald, including a fingerprint identification card. (FBI exhibit D-10.)



25. June 10, 1962. Two-page handwritten letter to the "Worker," 23 West 26th Street, signed Lee H. Oswald. Blue ink; ballpoint pen. Date was appended with a different pen. Location: Archives. (Document marked "A. Johnson exhibit No. 1"; JFK exhibit F-494.)
26. July 13, 1962. Letter to Leslie Welding Co., signed Lee H. Oswald; written on part of a page from a yellow legal pad. Blue ink; ballpoint pen. Location: Archives.
27. October 9, 1962. Application for P.O. Box No. 2915, signed Lee H. Oswald. Black ink; ballpoint pen. Location: Archives. (CE 791; JFK exhibit F-496.)
28. March 8, 1963. Photocopies of a note in Russian to Ruth Paine from Marina Oswald. Location: Archives. (CE 404.)
29. March 12, 1963. U.S. postal money order No. 2,202,130,462, bearing handwritten fill-ins as follows: Klein's Sporting Goods, A. Hidell, P.O. Box 2915, Dallas, Tex. Blue ink, ballpoint pen. Location: Archives. (CE 788; JFK exhibit F-509A and 509B.)
30. March 12, 1963. Enlargement of microfilm reproduction of Klein's order form for rifle from A. Hidell, superimposed on envelop, postmarked March 12, 1963, addressed to Klein's, Dept. 358, 227 W. Washington Street, Chicago 6, Ill., with return address: A. Hidell, P.O. Box 2915, Dallas, Tex. Location: Archives. (CE 773; Cadigan's exhibit 1; JFK exhibit F-504.)
31. May 4, 1963. Photograph of man with rifle and newspapers. On the back of the photograph is a handwritten notation reading "To my friend George from Lee Oswald 5/IV/63" and, in Russian, the statement "Copyright G de M." Also in Russian is writing which translated as "Killer of Fascists—Ha-Ha-Ha!!!" Blue ink; ballpoint pen. Location: House Select Committee on Assassinations (hereinafter HSCA), which obtained it from the effects of George de Mohrenschildt after his death in 1977. (JFK exhibit F-183 and 184, F-382 and 383.)
32. May 26 (1963)\* Two-page letter to Fair Play for Cuba Committee, signed Lee H. Oswald. Blue ink; ballpoint pen. Location: Archives. (Document also marked "V. T. Lee No. 2;" JFK exhibit F-497.)
33. June 15, 1963. Fair Play for Cuba Committee. New Orleans chapter, signed Lee H. Oswald, with A. J. Hidell signing as chapter president. Found in Oswald's wallet on the day of his arrest. Location: Archives. (JFK exhibit F-505.)
34. June 24, 1963. Passport application, signed Lee H. Oswald. Blue ink; ballpoint pen. Location: FBI. (CE 781; JFK exhibit F-40.)
35. June 24, 1963. Passport photograph attached to item 34, signed Lee H. Oswald. Blue ink; ballpoint pen. Location: Archives.
36. August 9, 1963. Fingerprint identification card of New Orleans Police Department, signed Lee H. Oswald. Blue ink; ballpoint pen. Location: Archives. FBI current arrest or receipt, dated August 12, 1963. Location: Archives. (JFK F-400.)
37. August 9, 1963. Photocopy of fingerprint card and attached mug shots, New Orleans Police Department, signed Lee H. Oswald. Location: FBI.

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\*Year was derived from content.



38. August 28, 1963. Handwritten letter to Central Committee C. P. (Communist Party), USA, signed Lee H. Oswald. Blue ink; ballpoint pen. Location: Archives. (Document also marked "A. Johnson exhibit No. 4"; JFK F-498.)
39. September 27, 1963. Photocopy of a page from a hotel register, signed, on line 18, "Lee, Harvey Oswald, U.S.A. (Texas) PHOTO. U.S. citizen." Location: Archives. (FBI exhibit D-36; JFK F-499.)
40. September 27, 1963. Photographs (one of the entire document and one of the signature) of the original of the visa application, Cuban Consulate, Mexico City, signed Lee H. Oswald. Location: Archives. (CE 2564; JFK F-407, entire document.)
41. September 27, 1963. Photograph of the carbon copy of item 40, shown to the committee staff when they met with President Fidel Castro in Havana, Cuba, with an original signature, Lee H. Oswald. Location: HSCA. (JFK F-408.)
42. October (no date), 1963. Letter to the Russian Embassy. (JFK F-500.)
43. October 15, 1963. Employment application, with face sheet signed Lee H. Oswald. Blue ink; ballpoint pen. Location: Archives. (FBI exhibit D-18; JFK F-503.)
44. October 16, 1963. Employee's W-4 withholding exemption certificate, signed Lee H. Oswald. Blue ink; ballpoint pen. Location: Archives. (FBI exhibit D-90; JFK F-501.)
45. November 1, 1963. Application for P.O. Box 6225, two cards, each signed Lee H. Oswald. Blue ink; ballpoint pen. Location: Archives. (CE 792; JFK F-495.)
46. November 1, 1963. Receipt for key to P.O. Box 6225, signed Lee H. Oswald. Blue ink; ballpoint pen. Location: Archives. (CE 792; JFK F-495.)
47. November 8, 1963. Two photographs of a facsimile copy of a handwritten letter to Mr. Hunt. One is of the entire document, the other an enlargement of the signature. These were obtained by the committee from a researcher in Dallas, Tex. Location: HSCA files. (JFK F-506.)
48. November 9, 1963. Photomechanical (halftone) reproduction of a typewritten letter to the Consular Division, Embassy, U.S.S.R., Washington, D.C., signed Lee H. Oswald. Location: Archives. (Photomechanical reproduction—CE 15; JFK F-500.)
49. July 18, 1964. Exemplar (standard) signatures and writing of Jack Ruby. Location: Archives.
50. Undated. Photograph of unsigned rough draft of item 48. Location: Archives. (JFK F-500.)
51. Undated. Handwritten speech, nine pages. Green ink; nib pen. Location: Archives. (FBI exhibit 117; CE 97; JFK F-508.)
52. Undated. Two receipts for salary from the Texas School Book Depository, signed Lee H. Oswald. (FBI exhibit 422.)
53. Undated (August?). Photograph of Cuban identification card, flight 751, signed Jack Ruby. (JFK F-583.) Location: HSCA files.
54. Undated. Exemplar writing of Marina Oswald, including seven slips of paper containing the writing "A. J. Hidell." Location: Archives, HSCA.

55. Undated. Dallas Public Library card, expiring December 7, 1965, signed Lee H. Oswald. Location: Archives. (JFK F-505, B1-10.)
56. Undated. Note in Russian, consisting of 10 lines of handwriting, signed, in Russian, "Alek." Location: Archives. (FBI exhibit 133; CE 40; JFK F-507.)
57. Undated. Note in Russian consisting of two pages of 11 handwritten instructions concerning the Walker incident, referred to as "the Walker Note." Location: Archives. (FBI exhibit D-30; CE 1; JFK F-510.)
58. Undated. Certificate of service, U.S. Marine Corps, signed Lee Harvey Oswald. Location: Archives. (FBI exhibit D-225.)
59. Undated. Social security card, 433-54-3937, Lee Harvey Oswald; unsigned. Location: Archives. (FBI exhibit D-225.)
60. Undated. Complimentary card, GA-Joen Kanko Hotel. Location: Archives.
61. Three photographs of Oswald, one with the notation on the back, "taken at Camp Pendleton Feb. 5." Location: Archives.
62. Undated. Slip of paper with the following handwriting:  
 "The Worke  
 23 W. 26th St.  
 New York 10, N.Y.  
 The Worker  
 Box 28 Madison  
 Sq. Station, New York 10, N.Y.  
 Embassy USSR.  
 1609 Decatur St. N.W.  
 Washington, D.C."  
 Location: Archives.
63. November 22, 1963. Photograph of fingerprint form of the Dallas Police Department. Location: FBI. (CE 627, 630.)

### *Procedures*

(23) The panel members traveled to Washington, D.C. at various times to examine and photograph originals of documents to be examined. These were located at four places: The National Archives, the Department of Defense, the FBI, and the offices of the committee. The panel members prepared photographs of the originals for further study in their own laboratories.

(24) The panel met as a whole on July 6, 1977, to review the original documents and discuss their respective findings. Each member then prepared a final report of his findings and conclusions (these also provide further detail on the procedures followed by each member).

(25) The panel followed standard procedures and techniques in its examinations. The writings and signatures were looked at individually and in juxtaposition with each other, taking into consideration the gross characteristics of the writing process, writing skill, slant, speed, proportions of the letters, ratio of small to capital letters, height ratio, lateral spacing, and overall writing pattern. Significant differences were looked for. A stereoscopic microscope was used for minute examination and comparison of individual letters and characteristics.

(26) Scalice examined and compared the inked impressions on the three fingerprint cards on June 8, 1978, at the latent print section of the Federal Bureau of Investigation in Washington, D.C.

## SUMMARY OF CONCLUSIONS

(27) With the restrictions and reservations stated in each panel member's final report,\* the members conclude, generally, that the signatures and handwriting purported to be by Oswald are consistently that of one person. Because of the poor condition of the historical diary, they are unable to conclude firmly whether it was written at one or more than one sitting. On balance, it appears to have been written at one or a few sittings.

(28) Purtell and McNally conclude the name "A. J. Hidell" was written on the 1963 Fair Play for Cuba card by the same person who wrote the exemplars attributed to Marina Oswald.

(29) Finally, McNally concludes that the name "Jack Ruby" written on an undated Cuban identification card was by the same person who wrote the exemplars attributed to Jack Ruby.

(30) Scalice concluded that all inked finger and palm prints were identical and were Lee Harvey Oswald's.

## FINDINGS AND CONCLUSIONS OF JOSEPH P. MC NALLY

*Procedures*

(31) I conducted an examination and comparison of the signatures and writings on the items described in this report. At the time of the initial work in Washington, D.C., I made color photomacrographs of the signatures and the writings on these documents. I then made slides from the photomacrographs, which I subsequently projected and studied. The signatures were a particular focus of my examination.

(32) I first met with committee staff in Washington, D.C., on September 7, 1977, to examine and photograph signatures and writings on documents available at the Department of Defense and the National Archives. On September 17, 1977, I went to the committee's offices to examine and photograph a photoreproduction designated item No. 47. On May 8, 1978, I returned to Washington, D.C., to make additional examinations and photographs. These were made at the Department of Defense, the National Archives, and the committee offices.

(33) On July 6, 1978, I met with other members of the handwriting panel to review the documents examined and to consult with them. Subsequently, I prepared my final report with my findings and conclusions.

*Conclusions*

(34) I. The signatures "Lee Harvey Oswald" and "Lee H. Oswald" on the following documents were all written by the same person:

- 1, 2, 4, 5, 7, 11, and 12. Marine Corps documents.
3. U.S. Armed Forces Loyalty Certificate.
6. USMC fingerprint form.
8. ID card—U.S. Armed Forces, Japan.
- 9 and 10. Three (3) passport signatures.
13. Carbon of U.S. Armed Forces Report of Discharge.

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\*In particular, members noted that not all documents were available in their original. It is standard practice in the profession of questioned document examination to make definitive conclusions only about documents examined in their original. Thus the panel members gave only tentative opinions for items provided them in some type of facsimile.



14. Selective Service registration.
  15. Selective Service card.
  17. Citizenship revocation.
  22. Support affidavit.
  25. Letter to "The Worker".
  - 27, 45 and 46. Signatures on U.S.P.O. applications (4).
  31. Photo of Lee Oswald (back).
  32. Letter to "Fair Play for Cuba".
  33. Fair Play for Cuba card.
  34. Passport application.
  36. New Orleans Police Department fingerprint form, dated Aug. 9, 1968.
  37. Photocopy of New Orleans Police Department fingerprint form.
  38. Letter to the "Communist Party U.S.A.".
  39. Hotel registry.
  40. Application for Cuban visa.
  41. Photograph of carbon of application for Cuban visa.
  42. Letter to Russian Embassy.
  43. Employment form.
  44. Form W-4.
  45. P.O. Box 6225 application.
  46. Receipt for key to P.O. Box 6225.
  48. Photomechanical copy of letter to Russian Embassy.
  55. Dallas Public Library card.
- (35) II. The script writing on the following documents was done by the same person :
17. Citizenship revocation.
  19. Stationery of Holland-American Line.
  20. Self-questionnaire.
  21. Photocopy of self-questionnaire.
  22. Support affidavit.
  25. Letter to "The Worker".
  29. Xerox of Klein's money order.
  32. Letter to "Fair Play for Cuba".
  38. Letter to "Communist Party U.S.A.".
  42. Letter to the Russian Embassy.
  48. Photomechanical copy of letter to Russian Embassy.
- (36) III. A number of documents have script and handprint, both of which are by the same person (the script writings of these documents correspond to that of documents listed above under I and II) :
16. Historical diary.
  18. Aline Mosby interview.
  26. Employment application with letter.
  30. Envelope and order form—Klein's.
  43. Employment application and letter of resignation.
- (37) IV. A few documents have handprint only. On those listed below, all the handprint is by the same person, and it corresponds to the handprint on documents listed above under III. Since the script in items under III corresponds to the script in items under II, it can be concluded that the items under II, III, and IV correspond.
9. Inside cover of passport.
  - 27, 45 and 46. U.S.P.O. forms—box rental.
  51. Speech.



(38) V. In summary, the script writing (much of it on documents also bearing the signature of Lee H. Oswald) is identifiable with the signatures, "Lee H. Oswald." From the script writing on the documents described in section II, it is possible to create composite signatures, "Lee Harvey Oswald" and "Lee H. Oswald," which correspond to the Oswald signatures on the documents listed in section I.

(39) VI. The Russian language writing on documents 23, 56, and 57 is by the same person. Although there are a few letter design forms which appear to be in the Cyrillic alphabet, the bulk are in the Latin alphabet and correspond to their counterparts in the script and hand-print in the documents listed in sections I, II, III, and IV above.

(40) VII. The two signatures, "Lee H. Oswald," in item 52 (receipts for salary—Texas School Book Depository) do not correspond to the Oswald signatures as described under section I. The handwriting appears to be more skillful, with a more rhythmic flow. It varies in slant and differs in proportion. The overall writing pattern differs from the Oswald signatures in section I, as do the individual letter designs. The "L" of item 52 is taller and without an eyelet loop at the top right of the "L" as found in the section I signatures. The "H" of item 52 is distinctly different from the "H" in the section I signatures. The "O" of item 52 retraces on itself, not the case in the section I signatures, where it loops around at the top right and usually swings into the following "s". The "d" of item 52 reverses slant to go backhand, which does not occur in the section I signatures.

(41) VIII. The signature, "Lee Harvey Oswald," on the Hunt note (item 47) does not correspond to the Oswald signatures described under section I. To begin with, the bulk of the documents which are signed with the full name, "Lee Harvey Oswald," are more formal in tone. For example, the full name appears on all but one of the Marine Corps documents. The full name appears infrequently elsewhere—usually only the first name, middle initial, and last name are used. Further, in the Hunt note, the middle name "Harvey" is misspelled—the "e" appears to be missing; the "H" of "Harvey" differs from that found in the section I signatures; the "ar" of "Harvey" is ellided to a point that does not occur in any section I signatures; the "O" of "Oswald" is retraced part of the way along the left side, not true of the section I Oswald signatures; and the ending "d" of Oswald is smaller than the preceding "l", whereas most of the ending "d"s of the section I signatures are taller than the "l" (only in signatures that appear to be "squeezed-in" is the end "d" shorter than the preceding "l").

(42) While the script writing on the Hunt note is similar in pictorial quality to the writings under section II, the format of the note differs from that of the notes and letters of section II. The writing line is so exact as almost to give the impression it has been made on a ruled line. Usually Oswald writes in an arhythmic manner—for example, with an irregular and crooked writing line. This writing creates the jumbled effect apparent in the section II documents.

(43) From the examinations of item 47, it was determined that the signature does not correspond with any of the Oswald signatures of section I. Similarly, the writing does not correspond to that in the section II Oswald documents.

(44) I would like to note, however, that the quality of the original photoreproductions of the Hunt note was poor. Under the best of cir-

cumstances, reproductions lack clarity and detail. Here, as can be seen from the copies, the original photoreproduction was out of focus, giving the document a fuzzy appearance. Accurate analysis was difficult. The note is highly suspicious. The original would have to be checked in order to make a more definite analysis and reach a definitive conclusion.

(45) IX. An examination and comparison was made of writings and signatures on documents attributed to Marina Oswald. The writings on the note (item 28) are such poor copies that it is virtually impossible to make a definite determination as to whether they correspond with the signatures of Marina Oswald on item 24. There is some similarity between the name in the return address on the envelope of item 28 and the signature of Marina Oswald on her entry papers (item 24), but the return address name is obscured to some extent by the postmark. The rest of the writing on the note (item 28) is not sufficiently parallel to the writing on her entry documents (item 29) and exemplars (item 54) to warrant any effective determination.

(46) The name, "A. J. Hidell" on the Fair Play for Cuba card (item 33) was examined and compared with the exemplar writings of Marina Oswald (item 54). It was determined that the "A. J. Hidell" of the card (item 33) was written by Marina Oswald (as in item 54). The writing pattern of the signature on the card corresponds with that of the name "A. J. Hidell" as written by Marina Oswald on item 54. The Hidell signature in question is written with the same degree of writing skill as evinced by Marina Oswald. The slant, speed, proportions, et cetera, of the Hidell signature is matched in the writings of Marina Oswald. The design, form, and execution of stroke making up the individual letters of the Hidell signature in question (item 33) correspond to those of the letters in the writing of Marina Oswald (item 54).

(47) X. The "Jack Ruby" signature on the Cuban identification card (item 53) was examined and compared with exemplars of Jack Ruby (item 49). It was determined that the "Jack Ruby" of the Cuban identification card was written by the author of the exemplar signatures attributed to Jack Ruby (item 49). While there is an odd "J" in the identification card which does not occur in the Ruby exemplars, the rest of the letters tally in all respects. The signature has been written quickly, easily, and fluently, consistent with the writing pattern of the known exemplars. The odd "J" may be "accidental" or could be accounted for in additional writing of Ruby, most likely in spontaneous writing contemporaneous with the signature of the identification card. "Request" writing, such as that of item 49, sometimes differs to a slight extent from "spontaneous" writing.

(48) XI. A check was made of the historical diary (item 16). The 12 pages were written with the same type of writing instrument. The paper used for 11 of the 12 pages is similar; only the last page differs—it is appreciably thinner. The writing has a continuity from page to page and line to line that is indicative of being written about, or at, the same time. It does not give the impression of being "random" as would be expected of a diary extended over a period of time. It appears that this diary has been written within a short period of time and not over any extensive period.

### *Summary of conclusions*

(49) Virtually all the Lee H. Oswald and Lee Harvey Oswald signatures are by the same person. There is some normal variation among the signatures, and no significant differences among the Oswald signatures identified as being the same. The overall writing pattern is consistently similar, and the individual letter designs match throughout without major differences. The same holds true for the script and handprint on these documents that are identified as being written by the same person.

(50) The same writing is on the U.S. Postal money order to Klein's (item 29) as is on the various letters and correspondence. The same writing is on the order form and envelope (item 30) as is on the letters and on the inside cover of the passport (item 9).

(51) The writing and signatures that appear on the letters (items 25, 32, 38, and 42) agree with the writing and signatures on the U.S. Post Office applications for post office boxes (items 27, 45, and 46).

(52) The signature and writing on the back of the photograph (item 31) agree with the signatures and script writing of Oswald (sections I and II).

(53) Differences indicative of different authorship were found on the "Hunt" note (item 47) and the salary receipts (item 52).

(54) It appears that the historical dairy (item 16) was written within a short period of time.

### FINDINGS AND CONCLUSIONS OF DAVID J. PURTELL

#### *Procedures*

(55) Items 1, 2, 4, 5, 6, 7, 8, 9, 11, 12, 15, 16, 17, 18, 19, 20, 22, 23, 24, 25, 27, 29, 31, 32, 33, 34, 36, 38, 39, 40, 43, 45, 47, 48, 51, 54, 55, 56, 57, 58, 59, 61, and 62 were studied, both visually and microscopically. A detailed drawing was made of all features observed in the writings. Later, each piece of writing was compared with every other piece of evidence. Photographs were taken of the evidence, and these were studied along with the detailed drawings. Thus the evidence was evaluated a total of three times.

#### *Findings*

(56) The examinations and comparisons revealed that all the writings were executed by a person having limited writing skill. The writings show physical evidence of natural movement and manner, with some normal variations. The carefree qualities and the unrestrained movements associated with genuine writing are present. None exhibit the characteristics of simulation produced by imitators attempting to duplicate the writing of another. The writings have similarities in the formation of letters, quality of writing, movement within the writing, size and proportions of letters and parts of letters, beginning and ending strokes, pen pressure, slope of the writing, spacing, alinement, direction, and speed.

(57) These similarities and the lack of any unexplainable differences resulted in the following findings and opinions:

(58) A. One person wrote the signatures, Lee Harvey Oswald, Lee H. Oswald, and Lee Oswald on documents 1, 4, 5, 6, 7, 8, 9, 11, 12, 15, 17, 22, 25, 27, 31, 32, 33, 34, 36, 38, 43, 45, and 55.



(59) B. The person who wrote the signatures on the above-listed documents also completed the messages on documents 17, 22, 25, 31, 32, 38, and 43.

(60) C. The person who wrote the signatures and completed the messages on the documents listed in A and B above executed the handwriting on documents 18, 19, 20, 48, 61, and 62.

(61) D. One person executed the handprinting appearing on documents 9, 27, 34, and 45, all of which were signed Lee H. Oswald.

(62) E. The person who hand printed the information on the documents listed in D above, also hand printed the material on document 51.\*

(63) F. With regard to the Russian writing on items 23, 56, and 57, this examiner is not familiar with this language and the characteristics of the various writing systems used.

(64) It is almost impossible to distinguish between class characteristics and individual characteristics unless the writing styles of a language are known.

(65) This examiner is, therefore, unable to render a definite opinion, but can point out that there are similarities between the writing in items 23, 56, and 57 and the handwriting on the items listed in A, B, and C above.

(66) G. With respect to the timespan of the historical diary (item 16), an answer cannot be provided because of the present condition of the paper. The documents had been processed by the silver nitrate method in an attempt to develop latent fingerprints. While a recognized method, the drawback is that it soils the paper; the silver nitrate which remains on the paper causes it to turn black in time. Today, the pages are in very poor condition, and though the message can be read in part, it is a very difficult task. One observation that can be reported is that one sheet of paper is of a different weight (thickness) than the other sheets.

(67) H. The committee requested that a determination be made as to whether the person who prepared items 24 and 54 also wrote the name, "A. J. Hidell" on the Fair Play for Cuba Committee card, dated June 15, 1963 (item 33).

#### *Known*

(68) Known handwriting of Marina Oswald appears in:

Item 24—one fingerprint identification card, dated March 24, 1962; and

Item 54—seven slips of paper containing the writing of the name, "A. J. Hidell" and "A. J. Hidell."

(69) The items above were examined to determine their individual writing features, as was the signature on the FPCC card (item 33). The two groups of writings were then compared.

(70) The examiner is of the opinion that the person who executed the handwriting on item 54 wrote the name, "A. J. Hidell" on the Fair Play for Cuba Committee card (item 33). This opinion is based on similarities in letter formation, quality of the writings, size, and proportions of the letters, beginning and ending strokes, pen pressure, and slant of the writing. No unexplainable differences could be noticed.

\*Attached to and made part of this report are photographic illustrations (Purtell Exhibits 1 and 2) made up of signatures demonstrating all the points of similarities noted above.



### *Limitations on the examination*

(71) Five items of evidence were not examined in the original, but were copies. Photocopies have several limitations. They do not reproduce all the fine details in handwriting needed in making an examination and comparison. At best, they do not produce as sharp an image as a properly produced photograph, and they lack tonal gradations, a result of the contrasting process of reproduction. In addition, it is possible to incorporate or insert changes and alterations into copies. A method frequently used is to paste together parts of documents to make one fraudulent document, which is then copied. If the first copy can pass inspection, it will be used; if not, it will be reworked to eliminate all signs of alteration. This amended copy is then recopied for the finished product. This is usually referred to as the "cut and paste" method.

(72) Document examiners only render a qualified or conditional opinion when working from copies. They stipulate that they have to examine the original before a definite opinion will be made.

(73) Because of problems with the following documents, no definite opinion can be rendered:

(74) Item 18, a halftone copy of a photograph of the original document. This is at least a third generation copy and is not suitable for comparison. (A halftone copy consists of very small dots and not continuous lines.)

(75) Item 29 was a Xerox copy made from a microfilm copy. Such a second generation copy has the defects of both processes.

(76) Item 39 was a photograph taken without a scale so that the magnification or reduction of the writing could not be determined.

(77) Items 40 and 41 were very poor quality photographs and lacked scales to determine the size of enlargements.

(78) Item 47 was a photograph of an out-of-focus facsimile copy. Instead of having clear discernible lines, the copy has indistinct and blurred outlines. Such a muddy and unclear copy gives the appearance that it might have been so made for a purpose.

(79) It should be noted that pictorial similarities can still be noticed between the handwriting appearing on items 18, 29, 39, 40, and 41 listed above, and the documents that have been identified as being written by one person (see A, B, and C). While the handwriting appearing in item 47 contains some of the pictorial similarities, the quality of the writing appears different, and the signature has a strange and distorted appearance.

[illegible]

<p>1. Name of Applicant</p> <p>2. Address</p> <p>3. City</p> <p>4. State</p> <p>5. Zip</p>	<p>6. Date of Birth</p> <p>7. Sex</p> <p>8. Marital Status</p> <p>9. Education</p> <p>10. Occupation</p>
<p>11. Signature of Applicant</p> <p>12. Date</p>	<p>13. Signature of Applicant</p> <p>14. Date</p>
<p>15. Signature of Applicant</p> <p>16. Date</p>	<p>17. Signature of Applicant</p> <p>18. Date</p>
<p>19. Signature of Applicant</p> <p>20. Date</p>	<p>21. Signature of Applicant</p> <p>22. Date</p>
<p>23. Signature of Applicant</p> <p>24. Date</p>	<p>25. Signature of Applicant</p> <p>26. Date</p>

<p>1. <i>Lee H. Oswald</i></p>	<p>2. <i>Lee H. Oswald</i></p>
<p>3. <i>Lee H. Oswald</i></p>	<p>4. <i>Lee H. Oswald</i></p>
<p>5. <i>Lee H. Oswald</i></p>	<p>6. <i>Lee H. Oswald</i></p>
<p>7. <i>Lee H. Oswald</i></p>	<p>8. <i>Lee H. Oswald</i></p>
<p>9. <i>Lee H. Oswald</i></p>	<p>10. <i>Lee H. Oswald</i></p>
<p>11. <i>Lee H. Oswald</i></p>	<p>12. <i>Lee H. Oswald</i></p>



## FINDINGS AND CONCLUSIONS OF CHARLES C. SCOTT

*Procedures*

(80) 1. I examined all documents except items 8, 23, 24, 28, 52, 56, 57, 60, 61, 62, and 63.

(81) 2. Minute scrutiny of the signatures and other handwriting purporting to be that of Oswald was conducted under a stereoscopic microscope with reflected light, sidelight from all angles, transmitted light, and ultraviolet rays. In addition, they were studied under infrared rays by means of an infrared image converter. (The primary purpose of the first two methods is to detect any evidence of tracings, alterations, erasures, or obliterated writing.)

(82) 3. Microscopic examination was also used to determine the color of ink and type of pen used in the execution of each document.

(83) 4. Photographs of original documents were studied in the laboratory in Kansas City.

(84) 5. Photographic comparison charts of the purported signatures of Oswald were prepared and evaluated for most of the documents.

(85) The above-described methods of examination were applied to all original documents submitted for examination, with the exception of two fingerprint cards, dated October 24, 1956, and August 9, 1963 (items 6 and 36), which were not received in time for this type of treatment.

(86) Photographic reproductions could only be compared visually with other photographic reproductions or with original documents. All conclusions based solely upon photographic reproductions are necessarily tentative and inconclusive, since they cannot reveal much about pen pressure and other dynamic qualities of handwriting. Further, they sometimes conceal, rather than reveal, evidence of tracings, alterations, erasures, or obliterated writing.

*Findings*

(87) *Question.* Are all of the signatures and other writings on the documents purported to have been written by Oswald by one and the same person?

(88) *Opinion.* After very careful examination and comparison of the documents provided, I am of the opinion that, on the following original documents, Oswald's purported signatures and other writings are all in the same handwriting and were all written by one and the same person.

(89) Item 1—October 24, 1956. U.S. Marine Corps enlistment contract and record, signed "Lee Harvey Oswald."

(90) Item 2—October 24, 1956. Carbon copy of item 1 bearing an original signature, reading "Lee Harvey Oswald."

(91) Item 3—October 24, 1956. Loyalty certificate for personnel in the Armed Forces, signed "Lee Harvey Oswald."

(92) Item 4—October 24, 1956. U.S. Marine Corps examination of applicant by recruiting officer, signed "Lee Harvey Oswald."

(93) Item 5—October 24, 1956. U.S. Marine Corps record of emergency data, signed "Lee Harvey Oswald."

(94) Item 6—October 24, 1956. Armed Forces fingerprint card, signed "Lee Harvey Oswald."

- (95) Item 7—October 25, 1956. U.S. Marine Corps miscellaneous information and index form, signed "Lee H. Oswald" in three places.
- (96) Item 9—c.\* September 10, 1959. U.S. passport, signed "Lee H. Oswald."
- (97) Item 10—c.\* September 10, 1959. Photograph on page 4 of U.S. passport, signed "Lee H. Oswald."
- (99) Item 11—September 11, 1959. U.S. Marine Corps notice of obligated service, signed "Lee Harvey Oswald."
- (100) Item 12—September 11, 1959. U.S. Marine Corps security termination statement, signed "Lee Harvey Oswald."
- (101) Item 15—September 14, 1959. Selective Service System registration card, signed "Lee H. Oswald."
- (102) Item 16—July 15, 1961 to January 4, 1962. Page 11 of a 12-page diary.
- (103) Item 17—November 3, 1959. Declaration requesting revocation of U.S. citizenship, signed "Lee Harvey Oswald."
- (104) Item 19—1960, undated. Handwriting on Holland-American Line stationery.
- (105) Item 22—January 17, 1962. Affidavit of support addressed to the American Embassy, Moscow, signed "Lee H. Oswald."
- (106) Item 25—June 10, 1962. Letter to the "Worker," 23 West 26th Street, signed "Lee H. Oswald."
- (107) Item 26—c. July 13, 1962. Letter to Leslie Welding Co., signed "Lee H. Oswald."
- (108) Item 27—October 9, 1962. Application for P.O. Box No. 2915, signed "Lee H. Oswald."
- (109) Item 31—May 4, 1963. Photograph of man with rifle. On the back of this photograph is a notation reading "To my friend George from Lee Oswald 5/IV/63."
- (110) Item 32—May 26, (1963?). Letter to Fair Play for Cuba Committee, signed "Lee H. Oswald."
- (111) Item 34—June 25, 1963. Passport application, signed "Lee H. Oswald."
- (112) Item 35—June 25, 1963. Passport photograph attached to application and signed "Lee H. Oswald."
- (113) Item 36—August 9, 1963. Fingerprint card of New Orleans Police Department, signed "Lee H. Oswald."
- (114) Item 38—August 28, 1963. Letter to central committee of the Communist Party, signed "Lee H. Oswald."
- (115) Item 43—October 15, 1963. Employment application, signed "Lee H. Oswald."
- (116) Item 44—October 16, 1963. Employee's withholding exemption certificate, signed "Lee H. Oswald."
- (117) Item 45—November 1, 1963. Two cards. Application for P.O. Box 6225, both signed "Lee H. Oswald."
- (118) Item 46—November 1, 1963. Receipt for key to P.O. Box 6225, signed "Lee H. Oswald."
- (119) Item 51—Undated. Handwritten speech.
- (120) I examined each of the above-described documents (with the exception of items 6 and 36) under a stereoscopic microscope by reflected light, side light from all angles, transmitted light, and ultra-

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\*Circa is used because a passport is usually signed by the holder after receipt, which is often different than that of the date of issuance.

violet rays. I also inspected them under infrared, using an infrared image converter.

(121) I did not find any evidence of tracing or copying in any of the signatures or other handwriting purporting to be Oswald's on any of the original documents, nor did I find any material erasures, alterations, or obliterations. All seem to have been executed in the ordinary course of business without any suspicious signs. Equally important, all the purported signatures and writings of Oswald on the above-described documents conform with each other in letter formation, slant, proportions, alignment, and connecting strokes—allowing for normal variation. If Oswald's writing were imitated by some other person, in all probability the imitations would display a slavish uniformity somewhat like that of rubber stamping. There was no such suspicious uniformity and lack of natural variation in the signatures and writings.

(122) Also highly significant was that all the signatures and handwriting on the above-described original documents were executed with the same type of free, rapid writing movement and without any indications of suspicious hesitations or skips.

(123) Where, as here, two or more writings conforming with each other in the pictorial aspects of form or design (allowing for natural variation) show evidence of having been written with the same type of writing movement and rhythm, and lack any indications of tracing or other imitative processes, the conclusion is inescapable that all were written by the same person.

(124) With respect to the carbon copies and photographic reproductions submitted for examination, the form or design, slant, proportions, connecting strokes, and the like conformed with the writing on original documents. Therefore, tentatively, and subject to modification should the original documents become available for examination, it is my opinion that the following are probably carbon copies or photo-reproductions, as the case may be, of documents bearing writings that conform with the writing on the original documents purporting to be Oswald's:

(125) Item 13—September 11, 1959. Carbon copy of Armed Forces of the U.S. report of transfer or discharge bearing a carbon copy of a signature reading "Lee Harvey Oswald."

(126) Item 18—November 15, 1959. Photocopy of handwritten account of interview with Miss Mosby.

(127) Item 21—1962, undated. Photocopy of document identified as a "self-questionnaire."

(128) Item 37—August 9, 1963. Photocopy of fingerprint card and mug shots taken by New Orleans Police Department, signed "Lee H. Oswald."

(129) Item 39—September 27, 1963. Photograph of a page from a hotel register, signed "Lee, Harvey Oswald."

(130) Item 40—September 27, 1963. Photographs (one of entire document and one of signature on visa application), Cuban Consulate, Mexico City, signed "Lee H. Oswald."

(131) Item 41—September 27, 1963. Photograph of carbon copy of item 40.

(132) Item 47—November 8, 1963. Two photographs of a letter to Mr. Hunt (one of entire document, the other an enlargement of signature).



(133) Item 48—November 9, 1963. Photomechanical (halftone) reproduction of typewritten letter to Soviet Embassy, signed "Lee H. Oswald."

(134) Item 50—Undated. Photograph of unsigned rough draft of Item 48.

(135) The photographs of the visa application (item 40) and of the carbon copy of the visa application (item 41) appear to be in the same handwriting as the other purported signatures of Oswald, as far as the pictorial aspects of form or design, slant, proportions, connecting strokes, et cetera, are concerned. Because the pictures are fuzzy, it is impossible to rule out tracing or some other method of imitative writing.

(136) It is impossible to determine positively whether the letter to Hunt (item 47) is or is not in the handwriting of the same person as the other writings purporting to be Oswald's.

(137) The photographs appear to be photographs of a document bearing handwriting of the same person as that in the other documents purporting to be Oswald's. It is true that the signature is not typical—"Harvey" is misspelled—but that could be due to haste. If not genuine, the original from which this photograph was made is certainly a clever imitation.

(138) It is recommended that an effort be made to obtain the originals of all of the above-described reproductions so that they can be submitted to the same thorough examination, given the original documents.

(139) *Question.* Although they purport to be the handwriting of one Hidell, were the postal money order (item 29) and the envelope addressed to Kleins (item 30) actually written by the person who wrote the signatures and other writings which purport to be Oswald's?

(140) *Opinion.* The original of the money order (item 29) was examined and compared with the original writings purporting to be Oswald's. I am of the opinion that the fill-ins on the face of this money order are in the handwriting of the same person as the signatures and writings purporting to be Oswald's. The writing on the money order conforms with the writing purporting to be that of Oswald on the other documents in every material way, including writing movement and rhythm, as well as the pictorial aspects of form or design, proportions, alinement, slant, and connections. It is also significant that the writing on this money order shows no indication of being a mere copy or imitation of the writing purporting to be that of Oswald. This money order was submitted in the original, and hence it was possible to give it a complete microscopic examination and to study it under the infrared image converter.

(141) The envelope addressed to Kleins (item 30) was available only in the form of a microfilm enlargement. This is even less satisfactory than a photocopy as a basis for an opinion on handwriting. It can only be said that as far as the pictorial aspects of form or design, proportions, alinement, slant, and connecting strokes are concerned, the writing on this envelope, although it purports to be that of one Hidell, conforms with the original writing submitted for examination which purported to be that of Lee Harvey Oswald.

(142) *Question.* Was the diary (item 16) written from day to day, as it is dated, or was it written at one sitting?



(143) Opinion. While the diary was submitted for examination in original form, it was almost completely unsuitable (with the exception of p. 11) for document examination because of treatment with fingerprint developer. Little patches of ink were unobscured, but these were insufficient as a basis for a definite conclusion. From the patches of ink that could be studied, there are indications that the same pen and ink could have been used to write the entire diary. However, this observation is based solely on microscopic examination; no chemical tests were made or authorized. Use of the same pen and ink (particularly when, as here, a fountain pen or a dip pen, rather than a ball-point pen, was used) is more consistent with the diary having been prepared at one time, or over a few consecutive writing sessions, than it is with execution from day to day over the extensive period covered.

*Concluding remarks*

(144) As far as original documents are concerned, the conclusion is that the signatures and writings on them which purport to be Oswald's are all in the handwriting of the same person. In those instances where reproductions of any kind were examined, it was found that the writing conformed in pictorial aspects with the writing purporting to be Oswald's on the original documents examined. Only a tentative opinion could be reached as to these reproductions.

(145) Attached are two photographic comparison charts, prepared by the examiner, one showing most of the signatures reading "Lee Harvey Oswald," placed close to each other for ready comparison, the other a composite of most of the signatures reading "Lee H. Oswald" and of one signature reading "Lee Oswald." Large mural-size reproductions of these charts, suitable for simultaneous viewing by a number of persons, are being sent to the committee under separate cover.

(146) The photographs on these charts were taken by this examiner, who also prepared the charts. They are reliable representations of all of the signatures depicted, and they show all signatures enlarged to approximately the same extent.

FINDINGS AND CONCLUSIONS OF VINCENT J. SCALICE

(147) The following inked impressions were examined and compared at the latent print section, Federal Bureau of Investigation, on June 8, 1978.

(148) 1. Fingerprint impressions of Lee Harvey Oswald:

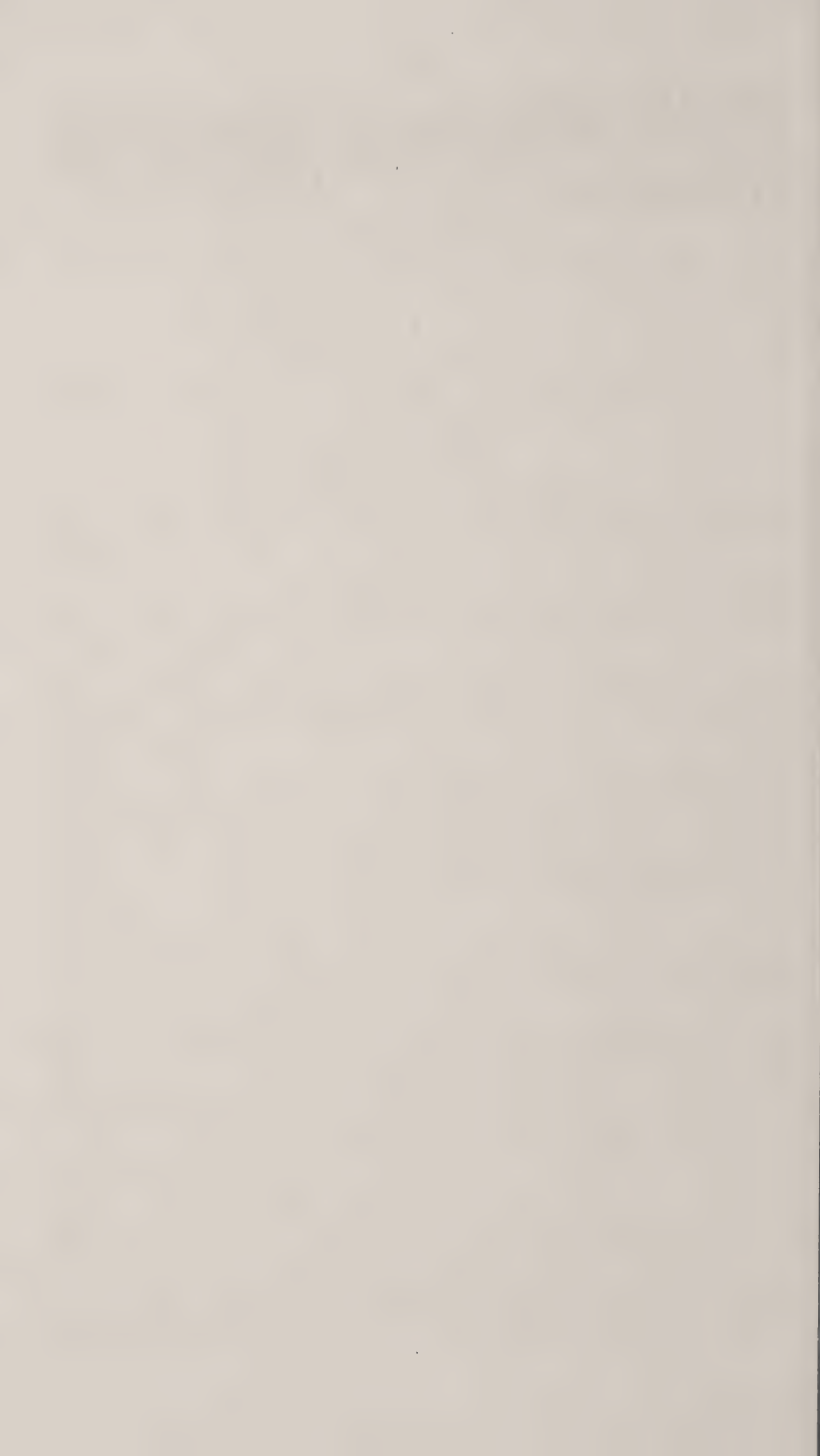
U.S. Marine Corps  
Service No. 1653230  
Prints taken by: Ogell W. Melam  
Date of prints: October 15, 1956  
Armed Forces No. 327925D  
Signed: Lee Harvey Oswald

(149) 2. Arrest fingerprint impressions of Lee Harvey Oswald:

Dallas, Tex. Police Department  
Dallas No. 54018  
Commission exhibit No. 630  
Prints taken by: Not indicated  
Date of prints: November 25, 1963  
Individual fingerprinted refused to sign same

- (150) 3. Arrest fingerprint impressions of Lee Harvey Oswald:  
 New Orleans, Louisiana Police Department  
 New Orleans No. 112-723  
 Prints taken by: Arthur M. James  
 Date of prints: August 9, 1963  
 Not signed by Lee Harvey Oswald
- (151) 4. Palm print impressions of Lee Harvey Oswald:  
 Dallas, Tex. Police Department  
 Left hand No. 628  
 Right hand No. 629  
 Prints taken by: J. B. Hicks  
 Date of prints: November 22, 1963
- (152) 5. Fingerprint impressions of Lee Harvey Oswald:  
 Dallas, Tex. Police Department  
 Commission exhibit No. 627  
 Prints taken by: J. B. Hicks  
 Date of prints: November 22, 1963
- (153) The inked fingerprint and palm prints of Lee Harvey Oswald appearing on exhibits 1-5 are identical and are those of Lee Harvey Oswald.
- (154) In addition, the following latent impressions were examined and compared with the inked fingerprint impressions of Lee Harvey Oswald at the latent print section, Federal Bureau of Investigation, on June 8, 1978.
- (155) 6. Latent fingerprint designated 4a recovered from brown paper container (wrapping) and developed by the Federal Bureau of Investigation. I identified it as the left index finger (no. 7) of Lee Harvey Oswald.
- (156) 7. Latent palm print, designated 4b, recovered from brown paper container (wrapping), developed by the Federal Bureau of Investigation. I identified it as the right palm of Lee Harvey Oswald.
- (157) 8. Latent fingerprint recovered from the trigger guard of a 6.5-millimeter, Mannlicher-Carcano rifle, serial no. C2766, processed at the Dallas Police Department. It is of no value for identification purposes.
- (158) 9. Lift from rifle (designated commission exhibit 139) from the underside of the foregrip at the gun barrel end of the foregrip of a Mannlicher-Carcano, serial no. C2766. I identified five characteristics or points of identity which match the lift.
- (159) 10. Latent palm print lifted from the underside of the gun barrel near the end of the foregrip, developed by the Dallas Police Department. I examined enlarged negatives which I identified as being identical to the right palm print of Lee Harvey Oswald.
- (160) 11. Palm print recovered from small cardboard box A (commission No. 641), by Federal Bureau of Investigation. I identified it as the left palm of Lee Harvey Oswald.
- (161) 12. Latent print (designated 2a) recovered from a cardboard box and processed by Federal Bureau of Investigation. I identified it as the right index finger (No. 2) of Lee Harvey Oswald.
- (162) 13. Latent palm print recovered from the bottom of a cardboard carton marked D, developed by Dallas Police Department. I identified it as identical to that of right palm print of Lee Harvey Oswald.

(163) 14. Latent fingerprint recovered from page 37 of the American Rifleman (June 1963), developed by the Federal Bureau of Investigation. An order blank for Klein's Sporting Goods Co. had been torn from page 59. I identified it as the right thumb (No. 1) of Lee Harvey Oswald.





## EXHIBITS\*

(1) October 24, 1956. Original of United States Marine Corps Enlistment Contract and Record, Service No. 1653230, signed Lee Harvey Oswald.



UNITED STATES MARINE CORPS  
ENLISTMENT CONTRACT AND RECORD

NAVMC 118 (2) AND (REV. 1-55)  
(DISPENSED NAVMC 118 (2) AND  
(REV. 1-55), WHICH WILL BE USED)

24 Oct 1956

1653230

1. LAST NAME—FIRST NAME—MIDDLE NAME OSWALD, Lee Harvey			2. RACE Cauc	3. SERVICE NO. 1653230	4. COMPONENT USMC
5. DATE OF BIRTH DAY MONTH YEAR 18 Oct 39	6. PLACE OF BIRTH (City) (State or country) New Orleans Louisiana	7. RELIGION Lutheran	8. CITIZENSHIP US	9. SEX M	

## 10. HOME OF RECORD AT TIME OF ENLISTMENT

STREET AND NUMBER OR R. F. D. NUMBER 4936 Collinwood Street	CITY OR TOWN Fort Worth	COUNTY OR PARISH Tarrant	STATE OR COUNTRY Texas
11. PLACE AT WHICH ENLISTED (City, county, and State) USMC RD Dallas, Texas	12. EFFECTIVE DATE OF ENLISTMENT DAY MONTH YEAR 24 October 1956	13. CONTRACT LIMITATION (if any) None	

## ENTRIES AS TO PREVIOUS SERVICE

14. DATE ENLISTED	15. DATE DISCHARGED	16. REASON	17. TIME LOST		18. BRANCH OF SERVICE	19. SERVICE NO.	20. TYPE OF DISCHARGE
			DAYS	CAUSE			
None Claimed							

21. RANK TO WHICH APPOINTED OR REAPPOINTED Pvt	22. TRANSFERRED TO USMC RDep, San Diego, California
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23. Examining Surgeon's Certificate. (This certification no longer used.)

24. For and in consideration of the pay or wages due in the grades which may from time to time be assigned me during the continuance of my service, I do hereby acknowledge to have voluntarily enlisted in the (strike one) (1) United States Marine Corps (2) Reserve of the United States Marine Corps, as a private, and I agree to and with R. K. JONES (Name of recruiting officer)

25. To enter the service of the United States Marine Corps and to report to such post or station of the Marine Corps as I may be ordered to join, and to the utmost of my power and ability discharge my several services or duties and be in everything conformable and obedient to the several requirements and lawful commands of the officers who may be placed over me.

26. I obligate and subject myself to serve unless sooner discharged by proper authority

WORD Three	YEARS	FIGURE 3	YEARS
---------------	-------	-------------	-------

(Word and figure to be in applicant's handwriting.)

27. In the event of war or national emergency declared by the President to exist during my term of service, I obligate and subject myself to serve until 6 months after the end of that war or national emergency if so required by the Secretary of the Navy unless I voluntarily reenlist or extend my enlistment.

28. I am of legal age to enlist; I have never been found guilty of a crime except as stated by me to the recruiting officer; I have never deserted from any of the Armed Forces of the United States, and have never been discharged therefrom for any reason other than recorded herein.

29. I understand that upon enlistment in the Reserve of the United States Marine Corps, or upon transfer or assignment thereto, I may not be ordered to active duty without my consent except in time of war, or when in the opinion of the President a national emergency exists, or when otherwise prescribed by law, and that I may be required to perform active duty during such periods.

30. I HAVE HAD THIS CONTRACT FULLY EXPLAINED TO ME. I UNDERSTAND IT, AND CERTIFY THAT NO PROMISE OF ANY KIND HAS BEEN MADE TO ME CONCERNING ASSIGNMENT TO DUTY, OR PROMOTION DURING MY ENLISTMENT.

31. Oath of Enlistment: I do solemnly swear (or affirm) that I will bear true faith and allegiance to the United States of America; that I will serve them honestly and faithfully against all their enemies whomsoever; and that I will obey the orders of the President of the United States and the orders of the officers appointed over me, according to regulations and the Uniform Code of Military Justice. And I do further swear (or affirm) that all statements made by me, as now given in this record, are correct.

SIGNATURE Lee Harvey Oswald  
(First name) (Middle name) (Last name)

Subscribed and sworn to before me this 24th day of October, A. D. 1956

SIGNATURE AND RANK OF RECRUITING OFFICER R. K. JONES, Capt., USMC, APO

U. S. GOVERNMENT PRINTING OFFICE 16-64323-3

- JFK EXHIBIT F-479



# UNITED STATES MARINE CORPS ENLISTMENT CONTRACT AND RECORD

 NAVJMC 118 (2)-PD (REV. 1-55)  
 OBSOLETE: NAVJMC 118 (2)-PD  
 (Orig. 1-43), WHICH WILL BE USED

NOV 27 1956

24 Oct 1956

APT-6 53 III

1. LAST NAME—FIRST NAME—MIDDLE NAME <b>OSWALD, Leo Harvey</b>			2. RACE <b>Cauc</b>	3. SERVICE NO. <b>- 1652230</b>	4. COMPONENT <b>USMC -1</b>
5. DATE OF BIRTH DAY <b>18</b> MONTH <b>Oct</b> YEAR <b>39</b>		6. PLACE OF BIRTH (City) <b>New Orleans</b> (State or country) <b>Louisiana</b>	7. RELIGION <b>Lutheran</b>	8. CITIZENSHIP <b>US</b>	9. SEX <b>M</b>
10. HOME OF RECORD AT TIME OF ENLISTMENT STREET AND NUMBER OR R. F. D. NUMBER <b>181039</b> CITY OR TOWN <b>Fort Worth</b> COUNTY OR PARISH <b>Tarrant</b> STATE OR COUNTRY <b>Texas</b>			11. CONTRACT LIMITATION (if any) <b>43942</b>		

12. EFFECTIVE DATE OF ENLISTMENT DAY <b>24</b> MONTH <b>October</b> YEAR <b>1956</b>			13. CONTRACT LIMITATION (if any) <b>None</b>
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14. DATE ENLISTED <b>11/3/42</b>		15. DATE DISCHARGED		16. REASON <b>None Claimed</b>		17. TIME LOST DAYS CAUSE		18. BRANCH OF SERVICE		19. SERVICE NO.		20. TYPE OF DISCHARGE	

21. BRANCH TO WHICH APPOINTED OR REAPPOINTED <b>Pvt</b>	22. TRANSFERRED TO <b>USMC BDEn, San Diego, California</b>
--	---

23. Examining Surgeon's Certificate. (This certification no longer used.)
24. For and in consideration of the pay or wages due in the grades which may from time to time be assigned me during the continuance of my service, I do hereby acknowledge to have voluntarily enlisted in the (strike one) (1) United States Marine Corps (2) ~~United States Marine Corps~~ as a private, and I agree to and with P. K. JONES (Name of recruiting officer) as a member of the United States Marine Corps (Position) as follows:
25. To enter the service of the United States Marine Corps and to report to such post or station of the Marine Corps as I may be ordered to join, and to the utmost of my power and ability discharge my several services or duties and be in everything conformable and obedient to the several requirements and lawful commands of the officers who may be placed over me.
26. I oblige and subject myself to serve unless sooner discharged by proper authority
- |                      |       |                    |       |
|----------------------|-------|--------------------|-------|
| WORD<br><b>Three</b> | YEARS | FIGURE<br><b>3</b> | YEARS |
|----------------------|-------|--------------------|-------|
- (Word and figure to be in applicant's handwriting.)
27. In the event of war or national emergency declared by the President to exist during my term of service, I oblige and subject myself to serve until 6 months after the end of that war or national emergency if so required by the Secretary of the Navy unless I voluntarily reenlist or extend my enlistment.
28. I am of legal age to enlist; I have never been found guilty of a crime except as stated by me to the recruiting officer; I have never deserted from any of the Armed Forces of the United States, and have never been discharged therefrom for any reason other than recorded herein.
29. I understand that upon enlistment in the Reserve of the United States Marine Corps, or upon transfer or assignment thereto, I may not be ordered to active duty without my consent except in time of war, or when in the opinion of the President a national emergency exists, or when otherwise prescribed by law, and that I may be required to perform active duty during such periods.
30. I HAVE HAD THIS CONTRACT FULLY EXPLAINED TO ME. I UNDERSTAND IT, AND CERTIFY THAT NO PROMISE OF ANY KIND HAS BEEN MADE TO ME CONCERNING ASSIGNMENT TO DUTY, OR PROMOTION DURING MY ENLISTMENT.
31. Oath of Enlistment: I do solemnly swear (or affirm) that I will bear true faith and allegiance to the United States of America; that I will support them honestly and faithfully against all their enemies whomsoever; and that I will obey the orders of the President of the United States and the orders of the officers appointed over me, according to regulations and the Uniform Code of Military Justice. And I do further swear (or affirm) that all statements made by me, as now given in this record, are correct.

 SIGNATURE Leo Harvey Oswald  
 (First name) (Middle name) (Last name)

 Subscribed and sworn to before me this 24th day of October, A. D. 1956

 SIGNATURE AND RANK OF RECRUITING OFFICER P. K. JONES, Capt., USMC APO

U. S. GOVERNMENT PRINTING OFFICE 16-64393-3

 PROCESSED By AP

-JFK EXHIBIT F-479 a-

(2) October 24, 1956. Carbon of Item 1, with an original signature, Lee Harvey Oswald.

NOV 27 1956

UNITED STATES MARINE CORPS  
ENLISTMENT CONTRACT AND RECORD

NAVJAG 118 (20-PO) (REV. 1-55)  
DISPENSED NAVJAG 118 (20-PO)  
DISP. 1-55, WHICH WILL BE USED

24 Oct 1956  
APVT-6 53 III

1. LAST NAME—FIRST NAME—MIDDLE NAME  
OSWALD, Lee Harvey

2. RACE  
Cauc

3. SERVICE NO.  
- 1852230

4. COMPONENT  
USMC -1

5. DATE OF BIRTH  
DAY 18 MONTH Oct YEAR 39

6. PLACE OF BIRTH (City) (State or country)  
New Orleans Louisiana

7. RELIGION  
Lutheran

8. CITIZENSHIP  
US

9. SEX  
M

10. HOME OF RECORD AT TIME OF ENLISTMENT  
1717 - 43942

STREET AND NUMBER OR R. F. D. NUMBER  
4936 Collinwood Street

CITY OR TOWN  
Fort Worth

COUNTY OR PARISH  
Tarrant

STATE OR COUNTRY  
Texas

11. PLACE AT WHICH ENLISTED (City, county, and State)  
USMC RS Dallas, Texas

12. EFFECTIVE DATE OF ENLISTMENT  
DAY 24 MONTH October YEAR 1956

13. CONTRACT LIMITATION (if any)  
None

ENTRIES AS TO PREVIOUS SERVICE  
241056

14. DATE ENLISTED  
None Claimed

15. DATE DISCHARGED

16. REASON

17. TIME LOST  
DAYS CAUSE

18. BRANCH OF SERVICE

19. SERVICE NO.

20. TYPE OF DISCHARGE

21. RANK TO WHICH APPOINTED OR REAPPOINTED  
Pvt

22. TRANSFERRED TO  
USMC RDen, San Diego, California

23. Examining Surgeon's Certificate. (This certification no longer used.)

24. For and in consideration of the pay or wages due in the grades which may from time to time be assigned me during the continuance of my service, I do hereby acknowledge to have voluntarily enlisted in the (strike one) (1) United States Marine Corps as a private, and I agree to and with R. K. JONES as follows:  
(Name of recruiting officer)

25. To enter the service of the United States Marine Corps and to report to such post or station of the Marine Corps as I may be ordered to join, and to the utmost of my power and ability discharge my several services or duties and be in everything conformable and obedient to the several requirements and lawful commands of the officers who may be placed over me.

26. I oblige and subject myself to serve unless sooner discharged by proper authority

WORD Three YEARS FIGURE 3 YEARS (Word and figure to be in applicant's handwriting.)

27. In the event of war or national emergency declared by the President to exist during my term of service, I oblige and subject myself to serve until 6 months after the end of that war or national emergency if so required by the Secretary of the Navy unless I voluntarily reenlist or extend my enlistment.

28. I am of legal age to enlist; I have never been found guilty of a crime except as stated by me to the recruiting officer; I have never deserted from any of the Armed Forces of the United States, and have never been discharged therefrom for any reason other than recorded herein.

29. I understand that upon enlistment in the Reserve of the United States Marine Corps, or upon transfer or assignment thereto, I may not be ordered to active duty without my consent except in time of war, or when in the opinion of the President a national emergency exists, or when otherwise prescribed by law, and that I may be required to perform active duty during such periods.

30. I HAVE HAD THIS CONTRACT FULLY EXPLAINED TO ME. I UNDERSTAND IT, AND CERTIFY THAT NO PROMISE OF ANY KIND HAS BEEN MADE TO ME CONCERNING ASSIGNMENT TO DUTY, OR PROMOTION DURING MY ENLISTMENT.

31. Oath of Enlistment: I do solemnly swear (or affirm) that I will bear true faith and allegiance to the United States of America; that I will serve them honestly and faithfully against all their enemies whomsoever; and that I will obey the orders of the President of the United States and the orders of the officers appointed over me, according to regulations and the Uniform Code of Military Justice. And I do further swear (or affirm) that all statements made by me, as now given in this record, are correct.

SIGNATURE Lee Harvey Oswald  
(First name) (Middle name) (Last name)

Subscribed and sworn to before me this 24th day of October, A. D. 1956

SIGNATURE AND RANK OF RECRUITING OFFICER R. K. JONES, Capt., USMC, APO

(U. S. GOVERNMENT PRINTING OFFICE 16-54383-3)

PROCESSED By FW

-JFK EXHIBIT F-479 a



(3) October 24, 1956. Loyalty Certificate for Personnel of the Armed Forces,  
signed Lee Harvey Oswald.

## LOYALTY CERTIFICATE FOR PERSONNEL OF THE ARMED FORCES

**1. PROVISIONS.** The Department of Defense has the authority to establish procedures implementing the national policy relating to loyalty of persons entering on duty with the Armed Forces. This has been determined by proper authority to include restrictions as to certain standards of conduct and membership in, or sympathetic association with, certain organizations.

### STANDARDS OF CONDUCT

1. Conduct which may be considered as establishing reasonable grounds for imposing appropriate penalties shall include but is not limited to, one or more of the following:

- Subsage, espionage, or attempts or preparations therefor, or intimate and sympathetic associations with or voluntary assistance to persons who the subject of investigation has reasonable cause to believe may be spies or saboteurs.
- Treason, sedition, or writings and acts which can reasonably be considered as intended to encourage seditious or treasonable opinions or actions.

(c) Advocacy of revolution or of force or violence to alter the existing constitutional form of government of the United States; advocacy of revolution or of force or violence to bring about economic, political, or social change.

(d) Intentional unauthorized disclosure to any person under circumstances which may indicate disloyalty to the United States, of documents or information of a classified or nonpublic character.

(e) Acting, attempting to act, or knowingly failing to act when such conduct is calculated to serve the interests of another government in preference to the interests of the United States of America.

### MEMBERSHIP IN OR ASSOCIATION WITH CERTAIN ORGANIZATIONS

2. Associations which may be considered as establishing reasonable grounds for imposing appropriate penalties include but are not limited to membership in, affiliation with, or sympathetic association with, any foreign or domestic organization, association, movement, group or combination of persons having the following characteristics:

- Which practices, seeks to practice, or advocates either:

(1) Denial, to any person, group of persons, or class of persons within the United States or territory subject to its jurisdiction, of any right or rights which the Federal Constitution guarantees or protects against encroachment by either or both Federal and State Government.

ments when such denial is attempted by force, violence, or intimidation, or;

(2) Alteration of the existing form of government of the United States or territory subject to its jurisdiction, or of the existing economic, social, or political order within it when such alteration is through or with the aid of force, violence, or intimidation.

(b) Which is disclosed by investigation, or is designated by the Attorney General of the United States to be totalitarian, fascist, communist, or subversive, or as having adopted a policy of advocating or approving the commission of acts of force or violence to deny persons their rights under the Constitution of the United States, or as seeking to alter the form of government of the United States by unconstitutional means regardless of practice, advocacy, or nonadvocacy of any of the tenets set forth in 1 (a) and 1 (b) above.

3. Organizations designated by the Attorney General, pursuant to Executive Order 10450, are listed below:

Communist Party, U. S. A., its subdivisions, subsidiaries and affiliates.  
Communist Political Association, its subdivisions, subsidiaries and affiliates, including—  
Alabama People's Educational Association.  
Florida Press and Educational League.  
Oklahoma League for Political Education.  
People's Educational and Press Association of Texas.  
Virginia League for People's Education.  
Young Communist League.  
Abraham Lincoln Brigade.  
Abraham Lincoln School, Chicago, Illinois.  
Action Committee to Free Spain Now.  
American Association for Reconstruction in Yugoslavia, Inc.  
American Branch of the Federation of Greek Maritime Unions.  
American Christian Nationalist Party.  
American Committee for European Workers' Relief.  
American Committee for Protection of Foreign Born.  
American Committee for the Settlement of Jews in Birobidjan, Inc.  
American Committee for Spanish Freedom.  
American Committee for Yugoslav Relief, Inc.  
American Committee to Survey Labor Conditions in Europe.  
American Council for a Democratic Greece, formerly known as the Greek American Council.  
Greek American Committee for National Unity.  
American Council on Soviet Relations.  
American Croatian Congress.  
American Jewish Labor Council.  
American League Against War and Fascism.  
American League for Peace and Democracy.  
American Lithuanian Workers Literary Association (also known as Amerikos Lietuvu Darbininku Literaturos Draugija).  
American National Labor Party.  
American National Socialist League.  
American National Socialist Party.  
American Nationalist Party.  
American Patriots, Inc.  
American Peace Crusade.  
American Peace Mobilization.  
American Poles for Peace.

American Polish Labor Council.  
American Polish League.  
American Rescue Ship Mission (a project of the United American Spanish Aid Committee).  
American-Russian Fraternal Society.  
American-Russian Institute, New York (also known as the American Russian Institute for Cultural Relations with the Soviet Union).  
American Russian Institute, Philadelphia.  
American Russian Institute of San Francisco.  
American Russian Institute of Southern California, Los Angeles.  
American Slav Congress.  
American Women for Peace.  
American Youth Congress.  
American Youth for Democracy.  
Armenian Progressive League of America.  
Associated Klans of America.  
Association of Georgia Klans.  
Association of German Nationals (*Reichsdeutsche Vereinigung*).  
Association of Lithuanian Workers (also known as *Lietuvu Darbininku Susijungimas*).  
Austrian Organization des NSDAP, Overseas Branch of Nazi Party.  
Baltimore Forum.  
Benjamin Davis Freedom Committee.  
Black Dragon Society.  
Boston School for Marxist Studies, Boston, Massachusetts.  
Bridges-Koberon-Schmidt Defense Committee.  
Bulgarian American People's League of the United States of America.  
California Emergency Defense Committee.  
California Labor School, Inc., 321 Divisadero Street, San Francisco, California.  
Carpatho-Russian People's Society.  
Central Council of American Women of Croatian Descent (also known as Central Council of American Croatian Women, National Council of Croatian Women).  
Central Japanese Association (*Baikoku Chuo Nipponjin Kai*).  
Central Japanese Association of Southern California.  
Central Organization of the German-American National Alliance (*Deutsche-Amerikanische Einheitsfront*).

Cervantes Fraternal Society.  
Chin Welfare Appeal, Inc.  
China Cultural Center.  
Citizens Committee to Free Earl Browder.  
Citizens Committee for Harry Bridges.  
Citizens Committee of the Upper West Side (New York City).  
Citizens Emergency Defense Conference.  
Citizens Protective League.  
Civil Liberties Sponsoring Committee of Pittsburgh.  
Civil Rights Congress and its affiliated organizations, including:  
Civil Rights Congress for Texas.  
Veterans Against Discrimination of Civil Rights Congress of New York.  
Columbians.  
Comite Coordinador Pro Republica Espanola.  
Comite Pro Derechos Civiles.  
Committee to Abolish Discrimination in Maryland.  
Committee to Aid the Fighting South.  
Committee to Defend the Rights and Freedom of Pittsburgh Political Prisoners.  
Committee for a Democratic Far Eastern Policy.  
Committee for Constitutional and Political Freedom.  
Committee for the Defense of the Pittsburgh Six.  
Committee for Nationalist Action.  
Committee for the Negro in the Arts.  
Committee for Peace and Brotherhood Festival in Philadelphia.  
Committee for the Protection of the Bill of Rights.  
Committee for World Youth Friendship and Cultural Exchange.  
Committee to Defend Marie Richardson.  
Committee to Uphold the Bill of Rights.  
Commonwealth College, Mena, Arkansas.  
Congress Against Discrimination.  
Congress of the Unemployed.  
Connecticut Committee to Aid Victims of the Smith Act.  
Connecticut State Youth Conference.  
Congress of American Revolutionary Writers.  
Congress of American Women.  
Council on African Affairs.  
Council of Greek Americans.  
Council for Jobs, Relief, and Housing.  
Council for Pan-American Democracy.



Christian Bureaucratic Fraternity.  
 Dai Nippon Buiko Kai (Military Virtue Society of Japan or Military Art Society of Japan).  
 Daily Worker Press Club.  
 Daniels Defense Committee.  
 Dame Aliphert Society (Between 1935 and 1940).  
 Dennis Defense Committee.  
 Detroit Youth Assembly.  
 East Bay Peace Committee.  
 Emergency Conference to Save Spanish Refugees (founding body of the North American Spanish Aid Committee).  
 Families of the Baltimore Smith Act Victims.  
 Families of the Smith Act Victims.  
 Federation of Italian War Veterans in the U. S. A., Inc. (Associazione Nazionale Combattenti Italiani, Federazione degli Stati Uniti d'America).  
 Finnish-American Mutual Aid Society.  
 Frederick Douglass Educational Center.  
 Freedom Stage, Inc.  
 Friends of the New Germany (Freunde des Neuen Deutschland).  
 Friends of the Soviet Union.  
 Garibaldi, American Fraternal Society.  
 George Washington Carver School, New York City.  
 German-American Band (Amerika-deutscher Volkshund).  
 German-American Republican League.  
 German-American Vocational League (Deutsche-Amerikanische Berufsvereinschaft).  
 Guardian Club.  
 Harlem Trade Union Council.  
 Hawaii Civil Liberties Committee.  
 Heimsuka Kai, also known as Nokubei Heiki Gimuska Kai, Zaihei, Nihonjin, Heijaku Gimuska Kai and Zaihei Heimsuka Kai (Japanese Kaiten in America Military Conscription Association).  
 Hellenic-American Brotherhood.  
 Hinode Kai (Imperial Japanese Reservists).  
 Hinomaru Kai (Rising Sun Flag Society—a group of Japanese War Veterans).  
 Hokubei Zengo Shoko Dan (North American Reserve Officers Association).  
 Hollywood Writers Mobilization for Defense.  
 Hungarian-American Council for Democracy.  
 Hungarian Brotherhood.  
 Independent Party (Seattle, Washington).  
 Independent People's Party.  
 Independent Socialist League.  
 Industrial Workers of the World.  
 International Labor Defense.  
 International Workers Order, its subdivisions, subsidiaries and affiliates.  
 Japanese Association of America.  
 Japanese Overseas Central Society (Kaigai Dobo Chuo Kai).  
 Japanese Overseas Convention, Tokyo, Japan, 1940.  
 Japanese Protective Association (Recruiting Organization).  
 Jefferson School of Social Science, New York City.  
 Jewish Culture Society.  
 Jewish People's Committee.  
 Jewish People's Fraternal Order.  
 Jiyokyo Lin Kai (The Committee for the Crisis).  
 Johnson-Forrest Group.  
 Johnsonites.  
 Joint Anti-Fascist Refugee Committee.  
 Joint Council of Progressive Italian-Americans, Inc.  
 Joseph Weydemeyer School of Social Science, St. Louis, Missouri.  
 Kibei Seinen Kai (Association of U. S. citizens of Japanese ancestry who have returned to America after studying in Japan).  
 Knights of the White Camellia.  
 Ku Klux Klan.

Kyllhauser, also known as Kyllhauser League (Kyllhauser (Hind)) Kyllhauser Fellowship (Kyllhauser Kameradschaft).  
 Kyllhauser War Relief (Kyllhauser Kriegshilfsverein).  
 Labor Council for Negro Rights.  
 Labor Research Association, Inc.  
 Labor Youth League.  
 League for Common Sense.  
 League of American Writers.  
 Lector Society (Indian Black Shirt).  
 Macedonian-American People's League.  
 Mario Morganini Circle.  
 Maritime Labor Committee to Defend Al Lannon.  
 Maryland Congress Against Discrimination.  
 Massachusetts Minute Women for Peace (not connected with the Minute Women of the U. S. A., Inc.).  
 Maurice Braverman Defense Committee.  
 Michigan Civil Rights Federation.  
 Michigan Council for Peace.  
 Michigan School of Social Science.  
 Nanka Teikoku Gungyudan (Imperial Military Friends Group or Southern California War Veterans).  
 National Association of Mexican Americans (also known as Association Nacional Mexicano-Americana).  
 National Blue Star Mothers of America (not to be confused with the National Blue Star Mothers of America organized in February 1942).  
 National Committee for the Defense of Political Prisoners.  
 National Committee for Freedom of the Press.  
 National Committee to Win Amnesty for Smith Act Victims.  
 National Committee to Win the Peace.  
 National Conference on American Policy in China and the Far East (a Conference called by the Committee for a Democratic Far Eastern Policy).  
 National Council of Americans of Croatian Descent.  
 National Council of American Soviet Friendship.  
 National Federation for Constitutional Liberties.  
 National Labor Conference for Peace.  
 National Negro Congress.  
 National Negro Labor Council.  
 Nationalist Action League.  
 Nationalist Party of Puerto Rico.  
 Nature Friends of America (since 1935).  
 Negro Labor Victory Committee.  
 New Committee for Publications.  
 Nichibei Kogyo Kaisha (The Great Fujii Theatre).  
 North American Committee to Aid Spanish Democracy.  
 North American Spanish Aid Committee.  
 North Philadelphia Forum.  
 Northwest Japanese Association.  
 Ohio School of Social Sciences.  
 Oklahoma Committee to Defend Political Prisoners.  
 Original Southern Klans, Incorporated.  
 Pacific Northwest Labor School, Seattle, Washington.  
 Palo Alto Peace Club.  
 Partido del Pueblo of Panama (operating in the Canal Zone).  
 Peace Information Center.  
 Peace Movement of Ethiopia.  
 People's Educational Association (Incorporated under name Los Angeles Educational Association, Inc.), also known as People's Educational Center, People's University, People's School.  
 People's Institute of Applied Religion.  
 Peoples Programs (Seattle, Washington).  
 People's Radio Foundation, Inc.  
 People's Rights Party.  
 Philadelphia Labor Committee for Negro Rights.  
 Philadelphia School of Social Science and Art.  
 Photo League (New York City).

Pittsburgh Arts Club.  
 Political Prisoners' Welfare Committee.  
 Polonia Society of the IWO.  
 Progressive German-Americans, also known as Progressive German-Americans of Chicago.  
 Proletarian Party of America.  
 Protestant War Veterans of the United States, Inc.  
 Provisional Committee of Citizens for Peace, Southwest Area.  
 Provisional Committee on Latin American Affairs.  
 Provisional Committee to Abolish Discrimination in the State of Maryland.  
 Puerto Rican Comité Pro Libertades Civiles (C.L.C.).  
 Puertorriquenos (Indios (Puerto Ricans United)).  
 Quaid City Committee for Peace.  
 Queenbridge Tenants League.  
 Revolutionary Workers League.  
 Romanian-American Fraternal Society.  
 Russian American Society, Inc.  
 Sakura Kai (Patriotic Society, or Cherry Association, composed of veterans of Russo-Japanese War).  
 Samuel Adams School, Boston, Mass.  
 Santa Barbara Peace Forum.  
 Schappes Defense Committee.  
 Schneiderman-Darcy Defense Committee.  
 School of Jewish Studies, New York City.  
 Seattle Labor School, Seattle, Washington.  
 Serbian-American Fraternal Society.  
 Serbian Vydovan Council.  
 Shinto Temples (limited to State Shinto abolished in 1945).  
 Silver Shirt Legion of America.  
 Slave Council of Southern California.  
 Slovak Workers Society.  
 Slovenian-American National Council.  
 Socialist Workers Party, including American Committee for European Workers' Relief.  
 Socialist Youth League.  
 Sokoku Kai (Fatherland Society).  
 Southern Negro Youth Congress.  
 Suiko Sha (Kierree Officers Association, Los Angeles).  
 Syracuse Women for Peace.  
 Tom Paine School of Social Science, Philadelphia, Pennsylvania.  
 Tom Paine School of Westchester, New York.  
 Trade Union Committee for Peace.  
 Trade Unionists for Peace.  
 Tri-State Negro Trade Union Council.  
 Ukrainian-American Fraternal Union.  
 Union of American Croats.  
 Union of New York Veterans.  
 United American Spanish Aid Committee.  
 United Committee of Jewish Societies and Landsmanschaft Federations, also known as Coordination Committee of Jewish Landsmanschaften and Fraternal Organizations.  
 United Committee of South Slavic Americans.  
 United Defense Council of Southern California.  
 United Harlem Tenants and Consumers Organization.  
 United May Day Committee.  
 United Negro and Allied Veterans of America.  
 Veterans of the Abraham Lincoln Brigade.  
 Voice of Freedom Committee.  
 Walt Whitman School of Social Science, Newark, New Jersey.  
 Washington Bookshop Association.  
 Washington Committee to Defend the Bill of Rights.  
 Washington Committee for Democratic Action.  
 Washington Commonwealth Federation.  
 Washington Persion Union.  
 Wisconsin Conference on Social Legislation.  
 Workers Alliance (since April 1916).  
 Workers Party (including Socialist Youth League).  
 Yiddisher Kultur Farband.  
 Yugoslav-American Cooperative Home, Inc.  
 Yugoslav Seamen's Club, Inc.

THE FOLLOWING ADDITIONS TO AND DELETIONS FROM THE ABOVE LIST ARE ANNOUNCED

#### ADD:

ELSNORE PROGRESSIVE LEAGUE  
 EVERYBODY'S COMMITTEE TO OUTLAW WAR  
 IDAHO PENSION UNION  
 MASSACHUSETTS COMMITTEE FOR THE BILL OF RIGHTS

THE FOLLOWING ADDITIONS TO AND DELETIONS FROM THE ABOVE LIST ARE ANNOUNCED: (CONTINUED)

**II. DECLARATION.** (Concealment of, misrepresentation as to, or failure to divulge in full, conduct or associations of the character set forth in the provisions at the time of execution of this certificate may constitute grounds for court martial, discharge, separation, or other disposition of personnel. Penalties for making a false statement may be very severe. If Federal Constitutional privilege against self incrimination, i.e., the making of a statement which will expose you to criminal trial, is claimed about all or any part of any conduct, membership, or association in question, you may so claim under Remarks below, "Federal Constitutional privilege is claimed" or "Federal Constitutional privilege is claimed as to . . ." describing the specific part of any conduct, membership, or association about which claim is made.)

#### CERTIFICATION

I certify, as regards the standards of conduct, or membership in or association with, certain organizations, that:

1. I have read the provisions applying to standards of conduct and membership in or association with certain organizations and I understand them.
2. If I have engaged in any such conduct, I have so indicated the nature thereof under Remarks below.
3. I have entered under Remarks below, the name(s) of the organization(s) from the above list of which I am or have been a member, or by which I am or have been employed, or which I have attended or been present at, or engaged in, organizational or social activities or activities which they sponsored, or for which I have sold, given away or distributed written, printed, or otherwise recorded matter published by them, or with which I have been identified or associated in some other manner.
4. If I have not engaged in any such conduct, or have not been associated in any manner with listed organizations, or have never been a member or participated in the activities of any pro-communist, pro-Nazi, or pro-Fascist organizations in foreign countries, I have so indicated by writing "NONE" or "None to my knowledge" under Remarks below.
5. I understand that if what I state below is found to be incorrect, incomplete, or misleading in any important particular, I may be subject to prosecution and punishment under the appropriate laws of the United States.
6. I understand the meaning of the statements made in the certifications above.

**REMARKS.** (Use the space provided below and attach additional sheets, if necessary, for a full detailed statement. If associated with any of listed organizations, specify nature and extent of association with each including dates, places, and credentials now or formerly held)

*None*

TYPED FULL NAME OF PERSON MAKING CERTIFICATION		SERVICE NO. (If any)	SIGNATURE OF PERSON MAKING CERTIFICATION	
OSWALD, Lee Harvey		1653230	<i>Lee Harvey Oswald</i>	
GIVEN UNDER MY HAND THIS		24th	DAY OF	October
TYPED NAME, GRADE AND ORGANIZATION OF WITNESSING OFFICER		19	56	AT USMC BS Dallas, Texas
R. K. JONES, Captain, USMC, ARO		<i>R. K. Jones</i>		

DD FORM 1 APR 55 98

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE.

☆ U. S. GOVERNMENT PRINTING OFFICE: 1955-O-355363

(4) October 24, 1956. United States Marine Corps Examination of Applicant by Recruiting Officer, signed Lee Harvey Oswald.

# EXAMINATION OF APPLICANT BY RECRUITING OFFICER

NAVMC 106 PD (REV. 4-54)  
SUPERBLES NAVMC 106 PD (REV. 3-51) WHICH WILL NOT BE USED

## INSTRUCTIONS

After the applicant's answers to the questions in PART I have been typed in, the applicant will read over and sign the form in the presence of the Recruiting Officer.

If an applicant admits having ever been arrested, that fact must be affirmatively shown, regardless of the triviality of the offense.

If an applicant has answered "YES" to one or more of the questions in PART I, the Recruiting Officer should consult the applicable section of the Marine Corps Manual and:

(1) Recommend waiver by completion of PART II and submit, in duplicate, to the Commandant of the Marine Corps (Code DP) prior to effecting enlistment or reenlistment; or

(2) Explain circumstances under item 31, if offense consists solely of traffic or parking violation or other minor nature not triable in Federal or State Courts, and waiver is not required by the Commandant of the Marine Corps; or

(3) Reject applicant for failing to meet the moral requirements.

If applicant is enlisted or reenlisted, this form will be forwarded with the duplicate of the Enlistment Contract and Record to the Commandant of the Marine Corps (Code DGK).

1. ORGANIZATION USMC RS Dallas, Texas				2. DATE 24 Oct 1956			
3. NAME OF APPLICANT (in full) OSWALD, Lee Harvey				4. DATE OF BIRTH 18 Oct 39			
5. APPLICANT FOR ENLISTMENT IN <input checked="" type="checkbox"/> BASIC <input type="checkbox"/> SEMIC		6. HIGHEST GRADE COMPLETED IN SCHOOL 9th		7. RACE Cauc		8. AFQT SCORE 58	
				9. MENTAL GROUP III		10. SERVICE NO. (when assigned) 1653230	
				11. PHYSICAL PROFILE P U L H E S 1 1 1 1 1 1			

or induction

## PART I

12. HAVE YOU EVER BEEN REJECTED FOR ENLISTMENT BY ANY BRANCH OF THE ARMED FORCES? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	IF SO, WHICH BRANCH, WHEN AND WHY?
13. HAVE YOU EVER BEEN ARRESTED? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	IF SO, FOR WHAT OFFENSE, WHEN AND WHERE?
14. HAVE YOU EVER BEEN CONVICTED OF A CRIME? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	IF SO, WHAT CRIME, WHEN AND WHERE?
15. HAVE YOU EVER BEEN SENTENCED BY ANY COURT? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	IF SO, WHEN, WHERE, FOR WHAT OFFENSE, AND FOR WHAT PERIOD?
16. HAVE YOU EVER BEEN IN JAIL, A REFORMATORY, INDUSTRIAL SCHOOL, OR PENITENTIARY? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	IF SO, WHEN AND WHERE?
17. HAVE YOU EVER RECEIVED A SUSPENDED SENTENCE BY ANY COURT? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	IF SO, WHEN, WHERE, FOR WHAT OFFENSE, AND FOR WHAT PERIOD?
18. ARE YOU NOW ON PAROLE, PROBATION, SUPERVISION, OR OTHER FORM OF CIVIL RESTRAINT? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	IF SO, EXPLAIN.
19. HAVE YOU EVER BEEN ON PAROLE, PROBATION, SUPERVISION, OR OTHER FORM OF CIVIL RESTRAINT? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	IF SO, EXPLAIN, GIVING DATE OF RELEASE.

20. I have been cautioned to answer the above questions truthfully; that any false statement detected prior to enlistment will constitute a bar to my enlistment, and that any false statement detected subsequent to enlistment will be processed as a fraud against the Government and may ultimately result in my discharge from the Marine Corps under other than honorable conditions.

Lee Harvey Oswald  
(signature of applicant)

## SEE INSTRUCTIONS

21. WAS THE OFFENSE FOR WHICH CONVICTED OR ADJUDICATED:

☐ CIVIL☐ CRIMINAL

22. (b) MARK: Following circumstances surrounding offense, in later dates, component, and branch service number, if applicant claims any prior service in any branch of the Armed Forces, list estimate of applicant's potential value for military service, and other pertinent information.

22. WAS THE OFFENSE FOR WHICH CONVICTED OR ADJUDICATED? (Applying laws of the State in which tried)

☐ FELONY☐ MISDEMEANOR☐ JUVENILE DELINQUENCY

23. AGE OF APPLICANT AT TIME OF OFFENSES

24. CITY AND STATE IN WHICH OFFENSES WERE COMMITTED

25. NAME OF COURT IN WHICH TRIED

DATE

26. IF FOUND GUILTY, WAS COURT ACTION DEEMED

☐ CONVICTION☐ ADJUDICATION AS A JUVENILE DELINQUENT, YOUTHFUL OFFENDER OR WAYWARD MINOR

27. OFFENSE FOR WHICH APPLICANT WAS CONVICTED OR ADJUDICATED IS PUNISHABLE BY (Apply laws of the State in which tried, if the length of sentence was indefinite or indeterminate, state the maximum punishment provided for the offense in the law under which convicted):

28. DATE OF RELEASE FROM CONFINEMENT

DATE OF RELEASE FROM PAROLE, PROBATION OR OTHER FORM OF SUPERVISION OR RESTRAINT (UNCONDITIONAL)

29. EMPLOYMENT RECORD SUBSEQUENT TO CONVICTION OR RELEASE FROM CONFINEMENT (Give inclusive dates)

## 30. INFORMATION WAS OBTAINED BY

☒

INTERVIEW OF APPLICANT

# OTHER EXPLAIN

VERBALLY FROM CIVIL AUTHORITIES

☒

REPORTS FROM CIVIL AUTHORITIES

EXAMINATION OF COURT RECORDS

OTHER

31. RECOMMEND THAT WAIVER BE GRANTED

☐ YES☐ NO

32. I CERTIFY that I have personally questioned the applicant whose signature appears hereon; that I am satisfied that he is fully qualified, in accordance with existing instructions, for enlistment in the Marine Corps (Reservist); and that he signed the foregoing questionnaire in my presence.

SIGNATURE AND RANK

Asst. (Recruiting Officer)

R. K. JONES, Captain U.S.M.C.

\* Omit when not applicable

FIRST ENDORSEMENT

DATE

FROM: COMMANDANT OF THE MARINE CORPS

TO:

1. Returned. Enlistment ☐ IS ☐ IS NOT authorized provided physically and otherwise qualified.

by direction



(5) October 24, 1956. United States Marine Corps Record of Emergency Data, signed Lee Harvey Oswald.

RECORD OF EMERGENCY DATA SEE INSTRUCTIONS ON REVERSE BEFORE MAKING ENTRIES				
1. DESIGNATOR'S LAST NAME—FIRST NAME—MIDDLE NAME <b>OSWALD, Lee Harvey</b>		2. SERVICE NO. <b>1653230</b>	3. GRADE OR RATE <b>Pvt</b>	4. SERVICE <b>USMC</b>
5. MARITAL STATUS <b>Not Married</b>	6. FULL NAME OF SPOUSE	7. ADDRESS (Number, street, city, zone, and State)		
8. CHILDREN (List each child of any marriage. If none, so state)				
FIRST NAME—MIDDLE NAME—LAST NAME	ADDRESS	MARITAL STATUS	SEX	DATE OF BIRTH
None				
9. NAME OF <input checked="" type="checkbox"/> FATHER OR <input type="checkbox"/> MALE GUARDIAN <b>Robert E. Lee OSWALD</b>		10. ADDRESS IF LIVING—IF DECEASED SO STATE <b>Deceased</b>		
11. NAME OF <input checked="" type="checkbox"/> MOTHER OR <input type="checkbox"/> FEMALE GUARDIAN <b>Marguerite (Claverie) OSWALD</b>		12. ADDRESS IF LIVING—IF DECEASED SO STATE <b>4936 Collinwood St., Fort Worth, Texas</b>		
IN THE EVENT THAT I AM NOT SURVIVED BY A SPOUSE OR ELIGIBLE CHILD I DESIRE THAT PAYMENT OF 6 MONTHS' DEATH GRATUITY BE MADE TO THE RELATIVE SHOWN BELOW. (The name of father or mother must be repeated if it is desired that he or she receive payment)				
13. FIRST NAME—MIDDLE NAME—LAST NAME <b>Marguerite OSWALD</b>	14. RELATIONSHIP <b>Mother</b>	15. ADDRESS <b>4936 Collinwood St., Fort Worth, Texas</b>		
16. ALTERNATE RELATIVE <b>John Edward PIC</b>	17. RELATIONSHIP <b>Step-Brother</b>	18. ADDRESS <b>4936 Collinwood St., Fort Worth, Texas</b>		
19. IN THE EVENT THAT I AM LISTED AS MISSING OR OTHER MILITARY CIRCUMSTANCES PREVENT ME FROM TRANSMITTING FUNDS TO MY DEPENDENTS, IT IS MY DESIRE THAT				
FIRST NAME—MIDDLE NAME—LAST NAME <b>Marguerite OSWALD</b>		RELATIONSHIP <b>Mother</b>		
ADDRESS <b>4936 Collinwood St., Fort Worth, Texas</b>		RECEIVE EACH MONTH <b>100</b> PERCENT OF MY PAY		
20. I REQUEST THE FOLLOWING COMMERCIAL INSURANCE COMPANIES BE OFFICIALLY NOTIFIED IN CASE OF MY DEATH IN ACTIVE SERVICE				
NAME OF COMPANY	ADDRESS OF HOME OFFICE		POLICY NO.	
None				
21. DESIGNATION OR CHANGE OF BENEFICIARY—SERVICEMEN'S INCENTIVITY (PL 83, 8th Cong.) (Does not operate as a designation or change of beneficiary of any insurance contracts issued by United States Government) ALL PREVIOUS DESIGNATIONS OF PRINCIPAL AND CONTINGENT BENEFICIARIES, IF ANY, UNDER SERVICEMEN'S INCENTIVITY ACT OF 1951, ARE HEREBY CANCELED, AND IT IS DIRECTED THAT SAID INCENTIVITY BE PAID TO:				
NAME	RELATIONSHIP	SHARE OR AMOUNT TO EACH BENEFICIARY		
<b>Marguerite OSWALD</b>	<b>Mother</b>	<b>Full Amount</b>		
WITNESSED BY (Signature on all copies) <i>[Signature]</i>		SIGNATURE OF SERVICEMAN (Sign all copies) <i>Lee Harvey Oswald</i>		
GRADE OR RATE OF WITNESS <b>Captain</b>	SERVICE NO. <b>052083</b>	DATE SIGNED <b>24 October 1956</b>		

DD FORM 1 FEB 52 93 Replaces DD Form 62, 1 Jul 50, which may be used.

16-4792-1

—JFK EXHIBIT F-478—

## INSTRUCTIONS

(Items for which no instructions are printed below are self-explanatory)

This form will be completed and maintained current by all officer and enlisted personnel in accordance with Navy: BuPers Manual Art B-2312; Marine Corps Manual Par 11223; USCG Pers Cir No. 30-50; AFR 35-38; ANGR 35-38.

All items must be completed. In the event you, the designator, become a casualty the persons named in items 6, 8, 9, and 11 will be notified. If notification is not desired due to health or other reason state in remarks. If there are no living relatives, the name and address of a friend may be entered in remarks. Continue any item in remarks if necessary.

**Item 4.**—Enter one of the following: USN, USNR, USMC, USMCR, USCG, USCGR, USAF (for Air Force add "Res" or "ANG" as appropriate only if not in active military service).

**Item 5.**—Enter single, married, widowed, divorced, or legally separated.

**Item 6.**—Spouse to whom alimony or support is legally payable must be shown even if divorced or legally separated.

**Items 9 and 11.**—If the person entered is in the class of guardian, indicate whether stepparent, foster parent, loco parentis, guardian, or adoptive parent.

**Items 13 and 16.**—If you do not desire to designate anyone enter "I decline to designate any person to receive this pay" in your own handwriting. Only designated relatives are eligible to receive payment without proof of dependency.

**Item 19.**—The "Missing Persons Act" provides that pay and allowances continue to accrue to the pay account of any service member for the period he is missing or captured and may be paid to the dependents for support. This item reflects your desires and is used as a guide in disposition of your pay. Allotments to dependents and insurance companies initiated prior to entering a missing status are continued in effect unless unusual circumstances indicate changes.

**Item 20.**—Completion of this item will insure that insurance companies listed are promptly notified when necessary. Accuracy in entering policy numbers will facilitate prompt settlement.

**Item 21.**—The indemnity is payable only to persons within the following classes:

(1) Spouse (husband or wife).

(2) Children.—The term "children" includes natural children, stepchildren, adoptive children. Illegitimate children are included only if designated.

(3) Parents.—The term "parents" includes natural parents, stepparents, adoptive parents or persons who stood in loco parentis to the insured at any time prior to entry into the active service for a period of not less than one year. Unless designated otherwise by the serviceman the term "parent" includes only the mother and father who last bore that relationship to the serviceman.

(4) Brothers and sisters.—The term "brothers and sisters" includes those of the half blood and those through adoption.

If the designated beneficiary or beneficiaries do not survive the insured, or if none has been designated, the indemnity will be paid to the first eligible class of beneficiaries according to the order set forth above and in equal shares if the class is composed of more than one person. If this order is in accord with your wishes state "No Designation." If the order is not in accord with your wishes you should name the person or persons in the class to receive the indemnity. Any person so named will be considered a principal beneficiary unless specifically designated as a contingent.

## DISPOSITION INSTRUCTIONS

NAVY: Original to BuPers, Washington 25, D. C. Attn.: Casualty Branch.

Duplicate—same as original.

Triplicate—file in service record at duty station.

MARINE CORPS: See Marine Corps Manual Par 11223.

COAST GUARD: See Personnel Circular No. 30-50.

AIR FORCE: See AFR 35-38 or ANGR 35-38.

REMARKS

(6) October 24, 1956. Armed Forces fingerprint identification card, numbered 327 925 D, signed Lee Harvey Oswald.

<b>ARMED FORCES</b>		LEAVE THIS SPACE BLANK		RACE <i>W</i>	
SIGNATURE OF PERSON FINGERPRINTED <b>MASTER</b>		SERIAL <i>327 925 D</i>		HEIGHT (inches) <i>5' 10"</i>	
PLACE OF ENLISTMENT, APPOINTMENT, ETC. <i>U.S. ARMY, TEXAS</i>		SERVICE NO. <b>1655250</b>		DATE OF BIRTH <i>10-13-33</i>	
DATE OF ENLISTMENT, APPOINTMENT, ETC. <i>24 OCTOBER 1956</i>		COLOR OF EYES <i>BRN</i>		LEAVE THIS SPACE BLANK <i>LEAD</i>	
SCARS AND MARKS		COLOR OF HAIR <i>BRN</i>		CLASS <i>1-1-1-1-1-1-1-1-1-1</i>	
SIGNATURE OF OFFICIAL, TAKING FINGERPRINTS <i>Bill H. Melan</i>		WEIGHT <i>135</i>		REF.	
DATE SIGNED BY OFFICIAL, TAKING FINGERPRINTS <i>10-23-56</i>		SEX <i>M</i>			



RECORDED

Date \_\_\_\_\_

Dear Sir:

who claims to have resided at \_\_\_\_\_  
\_\_\_\_\_ to \_\_\_\_\_ and whose fingerprints and personal

description are recorded hereon, an applicant for enlistment in the United States \_\_\_\_\_ It is requested that the following information be furnished from your files. A return envelope is inclosed for your convenience.

Very truly yours,

1 Inclosure

Return Envelope

(Recruiting Officer)

POLICE RECORD CHECK		CITY AND STATE	DATE
HAS APPLICANT A POLICE OR JUVENILE RECORD? (other than minor traffic violation) <input type="checkbox"/> YES <input type="checkbox"/> NO IF "YES," WHAT WAS THE OFFENSE OR CHARGE, DISPOSITION, AND SENTENCE?			
IS APPLICANT NOW UNDERGOING COURT ACTION OF ANY KIND? <input type="checkbox"/> YES <input type="checkbox"/> NO IF "YES," GIVE DETAILS			
DOES CIVIL CUSTODY EXIST? <input type="checkbox"/> YES <input type="checkbox"/> NO IF "YES," SPECIFY			
<input type="checkbox"/> ADULTICANT <input type="checkbox"/> MARRIED <input type="checkbox"/> SEPARATED <input type="checkbox"/> DIVORCED <input type="checkbox"/> WIDOWED <input type="checkbox"/> SINGLE <input type="checkbox"/> MARITAL STATUS UNKNOWN			
REMARKS  ① Police Info by Ruddy, Div. 5, 10-21-59, gal			
TITLE		SIGNATURE	

DD FORM 369  
1 AUG 50

U. S. GOVERNMENT PRINTING OFFICE : 1959 O - 315411



## MISCELLANEOUS INFORMATION

Social Security No. 422-51-2027

FORM 1		WEIGHT		COLOR EYES		COLOR HAIR		DATE	
66		INCHES		135		LBS.		Hazel	
								Brown	
								24 Oct 1956	
PHYSICAL PROFILE						ANNUAL ADMINISTRATIVE AUDIT COMPLETED			
DATE	P	U	L	M	E	S	CODE	SIGNATURE	DATE
24 Oct 56	1	1	1	1	1	1	A	C. J. Wilson	24 Oct 56
	1	1	1	1	1	1	A	C. J. Wilson	30 Oct 55
TOTAL SEA AND FOREIGN DUTY						REENLISTMENT BONUS:			
YEARS		MONTHS		PERIOD		(a) Paid \$ <u>Nine</u> reenlistment bonus <u>(Amount)</u> for <u>(Date)</u> <u>(Number)</u> reenlistment.			
DATE LAST RETURNED CONTINENTAL LIMITS OF U. S.		8 Dec 56		000000		(b) Prev pd \$ <u>Nine</u> total amt of reenl bonuses to include <u>(Amount)</u> <u>(Number)</u> reenlistment.			
DATES IDENTIFICATION CARDS ISSUED						SIGNATURE: <u>C. J. Wilson</u> By direction: <u>24 MAY 57</u>			
DATE ID TAGS ISSUED:						DATE: <u>15 DEC 1956</u>			
BLOOD TYPE: <u>A</u>						Articles UCMJ explained to me this date as required by Article 137, UCMJ.			
CAS MASK SIZE: <u>MLC</u>						Articles UCMJ explained to me this date as required by Article 137, UCMJ.			
DEPOSIT RECORD BOOK NO: <u>20</u>						Signature: <u>Lee H. Oswald</u> (Signature)			
CLASS SWIMMER						Signature: <u>Lee H. Oswald</u> (Signature)			

## INDEX

STANDARD PAGES		CHECK (✓)		DOCUMENTS INSERTED (Continued)	INITIAL
		INITIAL PAGE	A B		
ENLISTMENT CONTRACT	NAVMC 118(2)-PD	X			
RECORD OF SERVICE	NAVMC 118(3)-PD	X			
FITNESS REPORTS SUBMITTED	NAVMC 118(4)-PD				
PROMOTION AND REDUCTION	NAVMC 118(5)-PD	X			
TIME LOST; ALLOTMENT; WEAPONS FIRING	NAVMC 118(6)-PD	X			
INDIVIDUAL TRAINING RECORD	NAVMC 118(7)-PD				
OCCUPATIONAL SPECIALTY AND EDUCATION	NAVMC 118(9)-PD	X			
COMBAT RECORDS—MEDALS	NAVMC 118(9)-PD	X			
ADMINISTRATIVE REMARKS	NAVMC 118(11)-PD	X			
OFFENSES AND PUNISHMENT	NAVMC 118(12)-PD	X			
COURT MEMORANDA	NAVMC 118(13)-PD				
EMERGENCY DATA	DD FORM 93	X			
LEAVE RECORD	NAVMC 118(16)-PD	X			
SEA AND AIR TRAVEL	NAVMC 118(17)-PD	X			
RECORD OF INDIVIDUAL RIFLE	NAVMC 118(20)-SD	X			
DEPENDENT TRAVEL RECORD	NAVMC 118(21)-SD	X			
DOCUMENTS INSERTED		INITIAL			
<del>Statement of Military Reason</del>					
Parent's Consent		R.D.			
SA Action		R.D.			
				SIGNATURE OF MARINE (After photo affixed) <i>[Signature]</i>	
				DATE OF PHOTOGRAPH 22 Feb 64	
NAME (Last)		(First)	(Middle)	SERVICE NO. 1633230	

(8) May 8, 1958. Identification card, U.S. Forces, Japan.

U.S. FORCES, JAPAN (在日本軍)	
IDENTIFICATION CARD (身分證明書)	
Name (姓名) OSWALD, LEE H.	SN. (番号) 1653230
Grade (階級) PVT	
Organization (所属部隊) MACS-11 MAC-11 1st MAW	
Signature (署名) <i>See it signed</i>	

FEC - WFT - 177

49-116-Army-10 Admin Com-APFE 100M

Nationality (国籍) American
Date of Birth (生年月日) 18 October 1939
Identify Card No. (身分証明番号) 00646
Date of Issuance (発行日) 8 May 1958
Signature of Issuing Officer (発行官署名) R. E. Lewis Adjutant

(9) September 10, 1959. United States Passport No. 1733242, signed Lee H. Oswald.





UNCLAS 33243

Passport



United States of America

Department of State

## IMPORTANT

This passport is NOT VALID until signed by the bearer on page two. PLEASE fill in names and addresses below:

BEARER'S NAME AND ADDRESS IN THE UNITED STATES

Name

LEE H. Oswald

Address

7313 DAVANPORT ST

City

BEARER'S FOREIGN ADDRESS

405 K 7 APT 24 KALININGRAD ST

U.S.S.R.

IN CASE OF DEATH OR ACCIDENT NOTIFY:

Name

Robert Oswald

Address

2313 DAVANPORT ST FORT WORTH, TEXAS

## EXPIRATION AND RENEWAL

Unless limited to a shorter period, this passport expires two years from the date of issue shown on page two. You can RENEW it for not more than two additional years for a fee of five dollars. No matter when renewed, the period of renewal MUST end four years after date of original issue. This passport MUST be presented with your renewal application. Renewal is shown by a stamp placed in the passport.

## NEW PASSPORT

When this passport expires and you want a new one, this passport should be presented with your application for the New passport.

(SEE OTHER IMPORTANT INFORMATION ON INSIDE OF BACK COVER)

4/19 DAB



Photograph of bearer



UNITED STATES DEPARTMENT OF STATE  
WASHINGTON, D.C.

4

Renewal, extensions, amendments,  
limitations, and restrictions

This passport, properly visaced, is valid for travel in all countries unless OTHERWISE RESTRICTED. It is not valid for travel to or in any foreign state for the purpose of entering or serving in the armed forces of such a state.

This passport is not valid for travel to the following areas under control of authorities with which the United States does not have diplomatic relations: Albania, Bulgaria, and those portions of China, Korea and Viet-Nam under Communist control.

THIS PASSPORT IS NOT VALID  
FOR TRAVEL IN HUNGARY.

5

*Check for extensions, amendments,  
limitations, and restrictions*

Embassy of the United States of America  
at Moscow, U.S.S.R. JULY 10, 1961.  
THIS PASSPORT IS VALID ONLY FOR  
DIRECT TRAVEL TO THE UNITED  
STATES.  
*Richard E. Snyder*  
RICHARD E. SNYDER  
AMERICAN CONSUL

SEE PAGE 15

6

*Has*

EUROPEAN  
R.G. LE HAVRE  
-30 OCT 1959  
SENTREE.P.

S. M.  
R.G. LE HAVRE  
-30 OCT 1959  
SORTIE  
-H-

VISIT UP TO THREE MONTHS

IMMIGRATION OFFICER  
(123)  
-30 OCT 1959  
★ BOUTHAMPTON

10 OCT 1959  
IMMIGRATION  
OFFICER  
(144)  
ENDARKED  
LONDON AIRPORT

7

Туристская Visa

ВИЗА № 403339

г. Москва

БЕЗВИЗОВАЯ

г. Москва

г. Харьков

15 ОКТ 1959

г. Москва

г. Харьков

г. Харьков

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Visa

ЛАНТЕНУТ

115 X 1959

ВАНИКАЛА

г. Харьков

Зарегистрирован в Отделе Виз и Регистрации

УВД Мосгорсозета

г. Москва

до 22 октября 1959 г.

г. Харьков

г. Харьков

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г. Харьков

ВНЗ А № 305002

Видана 22 мая 1962 г.

Владельцу паспорта № 1733242

г.р. Сиддх Барвад

на Капелюш

1936

1018

по 12/26 снб уагое монго 10/1

через пограничний пункт



RECEIVED  
 DEPT. OF AGRICULTURE  
 DIVISION OF  
 FOREST SERVICE  
 WASHINGTON, D. C.  
 JUL 10 1900

This image shows a blank, aged, cream-colored page, likely an endpaper or flyleaf of a book. The paper has a slightly textured appearance with some minor discoloration and small dark spots, possibly due to age or handling. A faint horizontal line is visible near the top edge, suggesting a fold or a binding edge. The overall tone is warm and off-white.

A close-up photograph of a library book label. The label is white with black text. At the top, it says "C" and "A" in large, bold letters. Below that, it says "C" and "A" in smaller letters. The label is partially obscured by a large, dark, circular sticker with the letters "C" and "A" in white. The sticker is placed over the "C" and "A" text on the label. The background of the label is white, and the text is black. The sticker is dark and has a glossy finish. The overall image is a close-up of a library book label with a large "C" and "A" sticker.

AMERICAN FM  
MOSCOW

AMERICAN EMBASSY  
MOSCOW  
U.S.S.R.  
RENEWED MAY 1962  
EXPIRES SEPTEMBER 9, 1965  
JOSEPH P. MORRIS  
AMERICAN CONSUL  
paid: US \$3.00  
with item No. 4504  
total 4504

\_\_\_\_\_

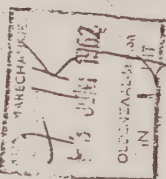


Visas

13

Visas

12



Embassy of the United States of America  
at Moscow, U.S.S.R. MAY 24, 1962.

THIS PASSPORT IS AMENDED TO  
INCLUDE DAUGHTER JUNE LEE.



*Joseph B. Norbury, Jr.*  
Joseph B. Norbury, Jr.  
Consul of the United States of America

IMM. & NATZ. SERVICE  
NEW YORK, N. Y. 33  
ADMITTED

JUN 13 1962

AMERICAN EMBASSY,	
MOSCOW,	CLASS
U.S.S.R.	TO
RENEWED	MAY 24, 1962
EXPIRES	JUNE 24, 1962
Service No. 1152091	JOSEPH B. NORBURY
Veriff Item No. 4	AMERICAN CONSUL
Fees paid: US \$5.00	
Local CY equal 4.50 Rubles	

SEE PAGE -6

WARNING—ALTERATION OR MUTILATION OF ENTRIES IS PROHIBITED

DESCRIPTIVE DATA SEE PAGE XXX 6 AND 15

NAME LEE HARVEY OSWALD			
WIFE X X X			
MINORS X X X SEE PAGE -14			
HEIGHT 5 FT. 11 IN.	HAIR BROWN	EYES GREY	VISIBLE MARKS X X X
BIRTHPLACE NEW ORLEANS, LA.			
BIRTH DATE OCT. 18, 1939		OCCUPATION SHIPPING EXPORT AGENT	
ISSUE DATE SEPT. 10, 1959		SIGNATURE OF BEARER <i>H. H. Smith</i>	

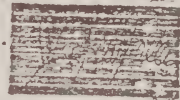
THIS PASSPORT IS NOT VALID UNLESS SIGNED BY  
THE PERSON TO WHOM IT HAS BEEN ISSUED

*I, the undersigned, Secretary of State of the United States of America,  
hereby request all whom it may concern  
to permit safely and freely to pass,  
and in case of need to give all lawful  
aid and protection to the above named  
citizen(s) of the United States.*

*Given under my hand and the  
seal of the Department of State.*



*Christian A. Herter*



WYDZIAŁ WYDAW.

Klas

ACQUITTÉ

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Klas

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WYDZIAŁ KONTROLI

WYDZIAŁ WYDAW.

Klas

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Kierownik Wydziału Konsularnego

Stanisław Kowacki

II Sekretarz Ambasady

Przejazd może trwać do dwóch dni

Moskwa, dnia 28. V. 1923.



(11) September 11, 1959. United States Marine Corps Notice of Obligated Service, signed Lee Harvey Oswald.

**NOTICE OF OBLIGATED SERVICE**

NAVMC 10276-PO (REV. 10-54)  
(SUPERSEDES (REV. 2-55) EDITION WHICH  
MAY BE USED FOR 8-YEAR OBLIGATIONS)

**INSTRUCTIONS**

Prepare in quadruplicate  
Original to Service Record Book  
Duplicate to CMC (Code DGH)  
Triplicate to member  
Quadruplicate to district director concerned  
X out those words which do not apply

NAME OF MEMBER <b>OSWALD, Lee Harvey</b>	SERVICE NO. <b>1653230</b>	RANK <b>PFC E-2</b>	MOS <b>6741</b>
---	-------------------------------	------------------------	--------------------

1. You, having assumed the 6-year military service obligation prescribed by law upon your ~~(induction)~~ (enlistment) in the  
**U. S. Marine Corps** ~~(Reserve)~~, on 24 October, 1956  
(Branch of Armed Forces initially entered)

✓ and having served in the United States Marine Corps ~~(Reserve)~~ from 24 October, 1956, to  
11 September, 1959, are hereby (released from active duty and transferred to the Marine Corps Reserve)

~~(released from the Marine Corps Reserve)~~ for the remainder of that 6-year period which ends on 8 December, 1962.

unless sooner discharged. During that period you are deemed by law to be a member of the Marine Corps Reserve and will be subject to such training and service as is now or may hereafter be authorized by law for members of the Marine Corps Reserve.

2. You are (assigned to) ~~(assigned to)~~ the (Ready) ~~(Standby)~~ Reserve, Class III (III). You are further (transferred to) ~~(transferred to)~~ the **Marine Air Reserve Training Command**

(Unit or district)

address of which is: **Naval Air Station, Glenview, Illinois**  
(Unit or district address)

You have given your future mailing address as: **3124 West 5th Street**  
**Forth Worth, Texas**

3. This Notice of Obligated Service executed for and on behalf of the United States Marine Corps at:

on 11 September, 1959

HEADQUARTERS and HEADQUARTERS SQUADRON  
MARINE CORPS AIR STATION  
EL TORO (SANTA ANA), CALIFORNIA

By

*(Signature and rank of officer executing notice)*  
**A. G. AYERS, JR., Lt., USMCR**

4. I hereby acknowledge receipt of this Notice of Obligated Service.

SIGNATURE OF MEMBER

*Lee Harvey Oswald*

This is to certify that a copy of this Notice of Obligated Service was ~~(delivered to)~~ (delivered to) the man named above.

SIGNATURE

*A. G. AYERS, JR.*  
**A. G. AYERS, JR., Lt., USMCR**

E 4 5 4 1 1

-JFK Exhibit F-485-

(12) September 11, 1959. United States Marine Corps Security Termination Statement and Index, signed Lee Harvey Oswald.

SECURITY TERMINATION STATEMENT  
OF NAV FORM 5511-14

HEADQUARTERS AND HEADQUARTERS SQUADRON  
U. S. MARINE CORPS AIR STATION  
EL TORO (SANTA ANA) CALIFORNIA

1. I hereby certify that I have conformed to the directives contained in the U. S. Navy Security Manual for Classified Matter and Registered Publication Manual in that I have returned to the Naval Establishment all classified matter which I have had in my possession.
2. I further certify that I am not retaining or taking away with me from my place of employment (duty) any document or thing containing or incorporating information affecting the National Defense of other matter Classified, Top Secret, Secret, or Confidential to which I obtained access during my employment (duty), in any manner whatsoever.
3. I shall not hereafter in any manner reveal or divulge to any person any information affecting the National Defense, Classified, Top Secret, Secret, or Confidential, or which I have gained knowledge during my employment (duty), except as may be hereafter authorized in writing by officials of the Naval Establishment empowered to grant such authority.

(If any of the above statements cannot truthfully be made, the word "not" shall be stricken out of the appropriate sentence and a full statement attached hereto indicating in detail the circumstances which prevent the making of the statement in its original form, including the names of the persons authorizing the particular handling of classified matter)

4. I, LEE HARVEY OSWALD 1653230 have been informed and am aware that 18 U. S. C., 1946 ed., Sup. IV, 792-797 and the Internal Security Act of 1950 prescribe severe penalties for unlawfully divulging information affecting the National Defense. I certify that I have read and understand appendices B, D, E, F, and H of the U. S. Navy Security Manual for Classified Matter, I have been informed and am aware that certain categories of Reserve and Retired personell on inactive duty can be recalled to duty, under the pertinent provisions of law relating to each class for trial by court-martial for unlawful disclosure of information. I have been informed and am aware that the making of a wilfully false statement herein renders me subject to trial therefore, as provided by 18 U. S. C., 1946 ed., Sup. IV, 1001.

A. G. FRES JR., 1stLt., USMCR 072172  
(Witness) (File of Ser No)

Lee Harvey Oswald 1653230  
(Full Name) (Ser No)

Officer in Charge Separation Section

11 September 1959  
(Date)

-JFK EXHIBIT F-484-

(13) September 11, 1959. Carbon copy of Armed Forces of the United States Report of Transfer or Discharge, signed Lee Harvey Oswald, with a carbon copy signature.

LEGEND: Insert N/A to the items below which are not applicable.

1. LAST NAME - FIRST NAME - MIDDLE NAME <b>OSWALD, Lee Harvey</b>		2. SERVICE NUMBER <b>1653230</b>		3. GRADE, RATE OR RANK <b>PFC (E-2)</b>		5. DATE OF BIRTH (Day, Month, Year) <b>11 Mar 59</b>	
4. DEPARTMENT, COMPONENT AND BRANCH OR <b>USMC</b>		6. PLACE OF BIRTH (City and State or Country) <b>New Orleans, Louisiana</b>		7. DATE OF BIRTH <b>11 Mar 59</b>		8. DATE OF BIRTH <b>11 Mar 59</b>	
7. RACE <b>Caucasian</b>		8. SEX <b>Male</b>		9. COLOR <b>Brown</b>		10. HEIGHT <b>71"</b>	
11. WEIGHT <b>150</b>		12. U.S. CITIZEN <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		13. MARITAL STATUS <b>Single</b>			
14. HIGHEST CIVILIAN EDUCATION LEVEL <b>High School - 1</b>		15. MAJOR COURSE OR FIELD <b>Academic</b>					
16. TYPE OF TRANSFER OR DISCHARGE <b>Transferred to Marine Corps Reserve</b>		17. STATION OR INSTALLATION AT WHICH EFFECTED <b>NAHS, MCAS, El Toro, (Santa Ana), California</b>					
18. REASON AND AUTHORITY <b>220-Dependancy. Par 1027) MARCORVET &amp; MCO 1900.2B &amp; CG JMWAVE's 5th Ed of 1 Jan 59</b>		19. DATE OF EFFECT <b>11 Sep 59</b>					
20. LAST BUTY ASSIGNMENT AND MAJOR COMMAND <b>MCAS, El Toro (Santa Ana), California</b>		21. CHARACTER OF SERVICE <b>HONORABLE</b>					
22. SELECTIVE SERVICE NUMBER <b>N/A</b>		23. SELECTIVE SERVICE LOCAL BOARD NUMBER, CITY, COUNTY AND STATE <b>N/A</b>					
24. DISTRICT OR AREA COMMAND TO WHICH RESERVIST TRANSFERRED <b>MARIC NAS, Glenside, Illinois</b>							
25. TERMINAL DATE OF RESERVE OBLIGATION <b>8 Dec 62</b>		26. CURRENT ACTIVE SERVICE OTHER THAN BY INDUCTION <input type="checkbox"/> UNLISTED (First Enlistment) <input type="checkbox"/> UNLISTED (Prior Service) <input type="checkbox"/> REENLISTED <input type="checkbox"/> OTHER:		27. TERM OF SERVICE (Years) <b>3</b>		28. DATE OF ENTRY <b>24 Oct 56</b>	
29. PRIOR REGULAR ENLISTMENTS <b>NONE</b>		30. GRADE, RATE OR RANK AT TIME OF ENTRY INTO CURRENT ACTIVE SERVICE <b>Private</b>		31. PLACE OF ENTRY INTO CURRENT ACTIVE SERVICE (City and State) <b>Dallas, Texas</b>			
32. HOME OF RECORD AT TIME OF ENTRY INTO ACTIVE SERVICE (Street, RFD, City, County, and State) <b>4536 Coliseum Street Port Huen, Tarrant, Texas</b>		33. STATEMENT OF SERVICE a. CREDITABLE FOR BASIC PAY PURPOSES b. TOTAL ACTIVE SERVICE c. TOTAL (Line (1) + Line (2))		34. YEARS MONTHS DAYS <b>2 9 3</b> <b>0 0 0</b> <b>2 9 3</b> <b>2 9 3</b>		35. DATE OF ENTRY <b>24 Oct 56</b>	
36. SPECIALTY NUMBER AND TITLE <b>6741: Radio Operator</b>		37. RELATED CIVILIAN OCCUPATION AND a. b. c. d. e. f. g. h. i. j. k. l. m. n. o. p. q. r. s. t. u. v. w. x. y. z. aa. ab. ac. ad. ae. af. ag. ah. ai. aj. ak. al. am. an. ao. ap. aq. ar. as. at. au. av. aw. ax. ay. az. ba. bb. bc. bd. be. bf. bg. bh. bi. bj. bk. bl. bm. bn. bo. bp. bq. br. bs. bt. bu. bv. bw. bx. by. bz. ca. cb. cc. cd. ce. cf. cg. ch. ci. cj. ck. cl. cm. cn. co. cp. cq. cr. cs. ct. cu. cv. cw. cx. cy. cz. da. db. dc. dd. de. df. dg. dh. di. dj. dk. dl. dm. dn. do. dp. dq. dr. ds. dt. du. dv. dw. dx. dy. dz. ea. eb. ec. ed. ee. ef. eg. eh. ei. ej. ek. el. em. en. eo. ep. eq. er. es. et. eu. ev. ew. ex. ey. ez. fa. fb. fc. fd. fe. ff. fg. fh. fi. fj. fk. fl. fm. fn. fo. fp. fq. fr. fs. ft. fu. fv. fw. fx. fy. fz. ga. gb. gc. gd. ge. gf. gh. gi. gj. gk. gl. gm. gn. go. gp. gq. gr. gs. gt. gu. gv. gw. gx. gy. gz. ha. hb. hc. hd. he. hf. hg. hh. hi. hj. hk. hl. hm. hn. ho. hp. hq. hr. hs. ht. hu. hv. hw. hx. hy. hz. ia. ib. ic. id. ie. if. ig. ih. ii. ij. ik. il. im. in. io. ip. iq. ir. is. it. iu. iv. iw. ix. iy. iz. ja. jb. jc. jd. je. jf. jg. jh. ji. jj. jk. jl. jm. jn. jo. jp. jq. jr. js. jt. ju. jv. jw. jx. jy. jz. ka. kb. kc. kd. ke. kf. kg. kh. ki. kj. kl. km. kn. ko. kp. kq. kr. ks. kt. ku. kv. kw. kx. ky. kz. la. lb. lc. ld. le. lf. lg. lh. li. lj. lk. ll. lm. ln. lo. lp. lq. lr. ls. lt. lu. lv. lw. lx. ly. lz. ma. mb. mc. md. me. mf. mg. mh. mi. mj. mk. ml. mn. mo. mp. mq. mr. ms. mt. mu. mv. mw. mx. my. mz. na. nb. nc. nd. ne. nf. ng. nh. ni. nj. nk. nl. nm. no. np. nq. nr. ns. nt. nu. nv. nw. nx. ny. nz. oa. ob. oc. od. oe. of. og. oh. oi. oj. ok. ol. om. on. oo. op. oq. or. os. ot. ou. ov. ow. ox. oy. oz. pa. pb. pc. pd. pe. pf. pg. ph. pi. pj. pk. pl. pm. pn. po. pp. pq. pr. ps. pt. pu. pv. pw. px. py. pz. qa. qb. qc. qd. qe. qf. qg. qh. qi. qj. qk. ql. qm. qn. qo. qp. qq. qr. qs. qt. qu. qv. qw. qx. qy. qz. ra. rb. rc. rd. re. rf. rg. rh. ri. rj. rk. rl. rm. rn. ro. rp. rq. rr. rs. rt. ru. rv. rw. rx. ry. rz. sa. sb. sc. sd. se. sf. sg. sh. si. sj. sk. sl. sm. sn. so. sp. sq. sr. ss. st. su. sv. sw. sx. sy. sz. ta. tb. tc. td. te. tf. tg. th. ti. tj. tk. tl. tm. tn. to. tp. tq. tr. ts. tt. tu. tv. tw. tx. ty. tz. ua. ub. uc. ud. ue. uf. ug. uh. ui. uj. uk. ul. um. un. uo. up. uq. ur. us. ut. uu. uv. uw. ux. uy. uz. va. vb. vc. vd. ve. vf. vg. vh. vi. vj. vk. vl. vm. vn. vo. vp. vq. vr. vs. vt. vu. vv. vw. vx. vy. vz. wa. wb. wc. wd. we. wf. wg. wh. wi. wj. wk. wl. wm. wn. wo. wp. wq. wr. ws. wt. wu. wv. ww. wx. wy. wz. xa. xb. xc. xd. xe. xf. xg. xh. xi. xj. xk. xl. xm. xn. xo. xp. xq. xr. xs. xt. xu. xv. xw. xx. xy. xz. ya. yb. yc. yd. ye. yf. yg. yh. yi. yj. yk. yl. ym. yn. yo. yp. yq. yr. ys. yt. yu. yv. yw. yx. yy. yz. za. zb. zc. zd. ze. zf. zg. zh. zi. zj. zk. zl. zm. zn. zo. zp. zq. zr. zs. zt. zu. zv. zw. zx. zy. zz.					
38. DECORATIONS, MEDALS, BADGES, COMMENDATIONS, CITATIONS AND CAMPAIGN RIBBONS AWARDED OR AUTHORIZED <b>NONE</b>		39. WOUNDS RECEIVED AS A RESULT OF ACTION WITH ENEMY FORCES (Place and date, if known) <b>NONE</b>		40. SERVICE SCHOOLS OR COLLEGES, COLLEGE TRAINING, COURSES AND/OR POST-GRADUATE COURSES SUCCESSFULLY COMPLETED a. SCHOOL OR COURSE b. DATES (From - To) c. MAJOR COURSE <b>Jacksonville, Florida 18 Apr 57 - 3 May 57</b> <b>Mobile, Mississippi 1 May 57 - 19 Jun 57</b> <b>Aviation School 18 Apr 57 - 3 May 57</b> <b>ACAS, El Toro</b>		41. OTHER SERVICE TRAINING COURSES SUCCESSFULLY COMPLETED <b>USAFI and ASLAV</b>	
42. GOVERNMENT LIFE INSURANCE IN FORCE <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		43. AMOUNT OF ALLIANCE <b>N/A</b>		44. MONTHLY ALLIANCE DISCOUNT <b>N/A</b>		45. VA CLAIM NUMBER <b>N/A</b>	
46. VA BENEFITS PREVIOUSLY APPLIED FOR (Specify type) <b>NONE</b>							
47. REMARKS <b>Long leave settlement due but not settled. Release paid \$20.00. His last current active duty: Forty-five (45) days Periods in a non-pay status: From 29 Jun 58 to 12 Aug 58 Good Conduct Medal period commences 27 Jun 58 (1st Award) Total payment on separation: \$122.30 (9/11/59)</b>		48. SIGNATURE OF PERSON BEING TRANSFERRED OR DISCHARGED <b>Lee Harvey Oswald</b>		49. SIGNATURE OF OFFICER AUTHORIZED TO SIGN <b>W. J. ...</b>		50. DATE OF ENTRY <b>11 Sep 59</b>	
51. PERMANENT ADDRESS FOR MAILING PURPOSES (Street, City, County, and State) <b>Port Huen, Tarrant, Texas</b>		52. SIGNATURE OF OFFICER AUTHORIZED TO SIGN <b>W. J. ...</b>		53. DATE OF ENTRY <b>11 Sep 59</b>		54. DATE OF ENTRY <b>11 Sep 59</b>	
55. LAST BUTY ASSIGNMENT AND MAJOR COMMAND <b>ACAS, El Toro</b>		56. SIGNATURE OF OFFICER AUTHORIZED TO SIGN <b>W. J. ...</b>		57. DATE OF ENTRY <b>11 Sep 59</b>		58. DATE OF ENTRY <b>11 Sep 59</b>	

DD FORM 1 NOV 58 214

REPLACES EDITION OF 1 JUL 52 WHICH IS OBSOLETE

ARMED FORCES OF THE UNITED STATES  
REPORT OF TRANSFER OR DISCHARGE

D-1807 5

24C

(14) September 14, 1959. Selective Service System Registration card, signed Lee H. Oswald.

3. NAME IN FULL <i>Last First Middle</i>				SELECTIVE SERVICE NUMBER	
OSWALD Lee Harvey				41 114 39 532	
2. PLACE OF RESIDENCE <i>Street and Number or RFD Route</i>				5. DATE OF BIRTH	
3124 West 5th St.				Oct 18, 1939	
<i>City, Town, or Village</i>		<i>Zone</i>	<i>County</i>	<i>State</i>	4. PLACE OF BIRTH
Fort Worth		7	Tarrant	Texas	New Orleans, La.
1. MAILING ADDRESS (If different from place of residence) <i>Street and Number or RFD Route</i>					
<i>City, Town, or Village</i>		<i>Zone</i>	<i>County</i>	<i>State</i>	
6. NAME AND ADDRESS OF PERSON WHO WILL ALWAYS KNOW YOUR ADDRESS					
Robert Oswald, 7313 Davenport St., Ft. Worth (Brother)					
7. OCCUPATION			8. NATURE OF BUSINESS, SERVICE RENDERED, OR CHIEF PRODUCT		
Unemployed					
9. FIRM OR INDIVIDUAL BY WHOM EMPLOYED					
10. PLACE OF EMPLOYMENT OR BUSINESS					
Form Approved Budget Bureau No. 33-R099.7.				SELECTIVE SERVICE SYSTEM REGISTRATION CARD	

SSS Form No. 1 (Revised 6-11-58)

(over)

D-18



11. Active duty in the Armed Forces of the United States or a cobelligerent nation since Sept. 16, 1940:

BRANCH OF ARMED FORCES OR COUNTRY <b>USMC</b>	SERVICE NO. <b>1653230</b>	DATE OF ENTRY <b>24 Oct 56</b>	DATE OF SEPARATION <b>11 Sep 59</b>
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12. Present membership in a reserve component of the Armed Forces:

BRANCH OF ARMED FORCES <b>USMC</b>	SERVICE NO. <b>1653230</b>	DATE OF ENTRY <b>11 Sep 59</b>	GRADE <b>Pfc</b>
---------------------------------------	-------------------------------	-----------------------------------	---------------------

ORGANIZATION **MARTC NAS  
Glenview, Ill**

I affirm that I have verified the foregoing answers and that they are true:

*X Lee H. Oswald*  
(Signature of registrant)

#### DESCRIPTION OF REGISTRANT

13. Color of eyes **Blue**..... Color of hair **Brown**..... Complexion **Med**..... Height (approx.) **5** **11** in

Weight (approx.) **150**..... Other obvious physical characteristics that will aid in identification: .....

.....None.....

I certify that my answers are true; that the person registered has read or has had read to him his own answers; that I have witnessed his signature or mark and that all of his answers of which I have knowledge are true, except as follows:

.....None to my knowledge.....

.....Sep 14, 1959.....

(Date of registration)

Registrar for Local Board **114**

(Number)

**Fort Worth**

(City or county)

*Rydia T. Sheridan*  
(Signature of registrar)

**Texas**

(State)

GPO : 1958 OF-489390

(15) September 14, 1959. Selective Service System registration certificate.

SELECTIVE SERVICE SYSTEM  
REGISTRATION CERTIFICATE

THIS IS TO CERTIFY THAT IN ACCORDANCE WITH THE SELECTIVE SERVICE LAW  
Lee Harvey OSWALD (LAST NAME)  
(FIRST NAME)  
SELECTIVE SERVICE NO. 114 37 532  
RESIDENCE AT REGISTRATION 3124 West 5th St.  
Port Worth 7 Tarrant Tex.  
(CITY OR VILLAGE) (NUMBER AND STREET OR R.F.D. NUMBER)  
(COUNTY) (STATE)  
Oct. 18, 1939 (DATE OF BIRTH) New Orleans, La.  
(DATE OF BIRTH) (PLACE OF BIRTH)  
WAS DULY REGISTERED ON THE 14 DAY OF Sept. 1959  
(SIGNATURE OF LOCAL BOARD CLERK)

MAIN FORM No. 2  
Rev. 1-1-59  
Approved for use by the Selective Service System

COLOR OF EYES Blue COLOR OF HAIR Brn.  
COMPLEXION Med.  
HEIGHT 5 ft 11 in WEIGHT 150

TEXAS LOCAL BOARD NO. 114  
SELECTIVE SERVICE SYSTEM  
RM 227 260 A. V. ALLEN ST.  
FORT WORTH, TEXAS

THE LAW REQUIRES YOU TO HAVE THIS CERTIFICATE IN YOUR PERSONAL POSSESSION  
AT ALL TIMES FOR IDENTIFICATION AND TO NOTIFY YOUR LOCAL BOARD OF ANY  
CHANGE OF ADDRESS.  
GPO: 1954 O-381648

(16) October 16, 1959 to March 27, 1962. Historical diary. 12 handwritten pages.

# HISTORIC DIARY

30

1959

FROM OCT. 16 1959 ARRIVAL -

LEAVING

1ST PAGE

OCT. 16. ARRIVE FROM NEISINKI BY TRAIN. AM MET BY INDUWAST REP. AND IN CAR TO HOTEL "BERLIN". REG. AS "STUART" - 5 DAY LVA. TOURIST. TICKET.) MEET MY INDUWAST GUID RIMMA SHENKINA. I EXPLAIN TO HER I WISH TO APPL. FOR RUS. CITIZENSHIP. SHE IS FLOUNDERED BUT AGREES TO HELP. SHE CHECKS WITH HER BOSS, MAIN OFFICE INDUWAST, WHO HELPS ME ADD. A LETTER TO SUP. SOVIET. ASKING FOR CITIZENSHIP. MEAN WHILE BOSS TELEPHONS PASSPORT & VISA OFFICE AND NOTIFIES THEM ABOUT ME.

OCT. 17 - RIMMA MEETS ME FOR INDUWAST SIGHTSEEING SAYS WE MUST CONTIN. WITH THIS ALTHOUGH I RATHER NEEDED SHE IS "SURE" I HAVE AN ANSWER. SECN. ASKS ME ABOUT MYSELF AND MY REASONS FOR DOING THIS. I EXPLAIN I AM A COMMUNIST. OCT. SHE IS POLITELY SYM. BUT UNHAPPY NOW. SHE TRIES TO BE A FRIEND TO ME. SHE FEELS SORRY FOR ME I AM SOMETH. NEW. SUBOT. 18. MY 20TH BIRTHDAY. W/ VIST EXHIB. IN MORNING AND IN THE AFTER NOON. THE LEVIN-STALIN TOMB. SHE GIVES ME A PRESENT BOOK "IDiot" BY DESTOEVSKI.

OCT. 19. TOURISM. AM ANXIOUS SINCE MY VISA IS GOOD FOR FIVE DAYS ONLY AND STILL REQUIRED FROM AUTH. ABOUT MY REQUEST.

OCT. 20. RIMMA IN THE AFTER NOON SAYS INDUWAST WAS NOTIFIED BY THE PASS. & VISA DEPT. THAT THEY WANT TO SEE ME. I AM EXCITED GREATLY BY THIS NEWS.

OCT. 21. (MOR.) MEETING W/ IN SIGAL OFFICIAL. DALLING STOUT, BLACK SUIT FAIRLY GOOD ENGLISH. ASKES WHAT DO I WANT? I SAY SOVIET CITIZENSHIP. HE ASKS WHY I GIVE VALUE MYSELF ABOUT "GREAT SOVIET UNION". HE TELLS ME "USSR ONLY GREAT IN LITERATURE WANTS ME TO GO BACK HOME" I AM STUNNED. I REITERATE. HE SAYS HE SHALL CHECK AND LET ME KNOW WEATHER MY VISA WILL BE (EXTENDED IT ENTERS TODAY).

EVE. 6.00 RECEIVE WORD FROM POLICE OFFICIAL. I MUST LEAVE COUNTRY TONIGHT AT. ELCHIN AS VISA REP. AS. I AM SHOCKED!! MY DREAMS! I RETIRE TO MY ROOM. I HAVE

SICO. LEFT. I HAVE WAITED FOR 2 YEARS TO BE ACCEPTED MY FONDLY DREAMS ARE SHATTERED BECAUSE OF A PETTY OFFICIAL, BECAUSE OF BAD PLANNING I FINISHED SO MUCH. 7.00 AM. I DECIDE TO END IT. SOAK RIST IN COLD WATER TO NUMB THE PAIN. THEN SLASH MY LEFT WRIST. I AM PAIN WRIST INTO BATHROOM OF HOT WATER. I THINK WHEN RIMMA COMES AT 8. TO FIND ME DEAD IT WILL BE A GREAT SHOCK. SOMEONE WILL FIND ME.

31

DIARY — 2nd Nov

Oct. 21 (Sun.) "WASH MY LIFE WHIRL AWAY. I THINK TO MYSELF  
"HOW EASY TO LIVE" AND "A SWEET DEATH, (TO VISITORS) ABOUT 100  
RIMMA FINDS ME UNCONSCIOUS (BATHING WATER A RICH RED COLOR)  
SHE SCREAMS (I REMEMBER THAT) and runs for help. AMBULANCE  
COMES, AM TAKEN TO HOSPITAL. WHERE FIVE STICKS ARE PUT  
IN MY WRIST. POOR RIMMA STAYS BY MY SIDE AS INTERPRETER.  
(MY RUSSIAN IS STILL VERY BAD) FAR INTO THE NIGHT, I TELL HER  
"GO HOME" (MY BLOOD IS BAD) BUT SHE SAYS, SHE IS "MY FRIEND"  
SHE HAS A STRONG WILL ONLY AT THIS MOMENT I NOTICE SHE IS PRETTY

OCT. 22. HOSPITAL I AM IN A SMALL ROOM WITH ABOUT 12 OTHERS  
(SICK PERSONS.) 2 DOCTORS AND A NURSE. THE ROOM IS VERY DIRTY  
AS WELL AS THE BATHROOM. ONLY AFTER PROLONGED (2 HOURS)  
OBSERVATION OF THE OTHER PAT. DO I REALIZE I AM IN THE INSANITY  
WARD. THIS REALIZATION DISGUSTS ME. LATER IN AFTERNOON I  
AM VISITED BY RIMMA, SHE COMES IN WITH TWO DOCTORS AS ENTHUSIAST  
SHE MOST ASK ME MEDICAL QUESTIONS. DID YOU KNOW WHAT YOU  
WERE DOING? ANS. YES DID YOU BACK OUT? NO. ETC. I THANK COME.  
ABOUT FOOD THE DOCTORS LAUGH APP. THIS IS A GOOD SIGN  
LATER THEY LEAVE, I AM ALONE WITH RIMMA (AMONGST THE  
MENTALLY ILL) SHE ENCOURAGES ME AND SCOLLS ME. SHE  
SAYS SHE WILL HELP ME TO GET TRANSFERRED TO ANOTHER SECTION  
OF HOS. (NOT FOR INSANE) WHERE FOOD IS GOOD.

OCT. 23. TRANSFERRED TO ORDINARY WARD, (AUX, GOOD FOOD.)  
BUT NURSES SUSPICIOUS OF ME. [THEY KNOW]. AFTERNOON I AM  
VISITED BY ROSE ANA FONON OF THE HOTEL <sup>TOURIST OFFICE,</sup> WHO ASKES ABOUT  
MY HEALTH, VERY BEAUTIFUL, EXCELLENT ENG., "VERY HEARTY AND  
KIND, SHE MAKES ME VERY GLAD TO BE ALIVE. LATER RIMMA VISITS

OCT. 24 HOSPITAL ROUTINE, RIMMA VISITS ME IN AFTERNOON

OCT. 25. " "

OCT. 26 AN ENERGY AMERICAN AT THE HOSPITAL GROW SUSPICIOUS  
ABOUT ME FOR SOME REASON. ~~PHOTOGRAPH~~ BECAUSE AT EMBASSY I TOLD  
HIM I HAD NOT REGISTERED AS TOURIST AND I AM IN GENERAL  
ENTHUSIAST ABOUT MY PRESENCE IN MOSCOW. BUT HOSPITAL <sup>RIMMA VISITS.</sup>

OCT. 27. STICKS ARE TAKEN OUT BY DOCTOR WITH "DULL" DISCISEOR  
OCT. 28. I LEAVE HOSPITAL IN INTERMITTENT CHARGE WITH RIMMA FOR  
HOTEL "BERLIN" LATER I CHANGE HOTELS TO "METROPOLE". ALL CLOTHES  
PACKED AND MONEY FROM MY POCKET IN THE LAST KOPEEK (RETURNED  
AS WELL AS WATCH, JEWELRY, CIGARETTES, SIMITSKA (TOURIST OFFICE CARD)  
AND BOSTA I VISIT ME TO COME AND SIT AND TALK WITH THEM  
AND TRY - I GET LONELY AT NEW HOTEL. THEY FEEL SORRY FOR ME -



$$x_1 = x_2 = \dots = x_n = 0 \quad \text{and} \quad x_{n+1} = 1$$

See  
Oct  
31<sup>st</sup>  
INTERVIEW

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3 1959

H.S. DIARY

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SAT. OCT 31, CON WARNED me not to ~~take~~ <sup>take</sup> any steps before the Soviets accept me, says I am a "god", and says the dissolution papers are along time in preparing (in other words REFUSES TO ALLOW ME AT THAT TIME TO DISSOLVE U.S. C.I.T.). I STATE "MY MIND IS MADE UP" FROM THIS DAY FORWARD I CONSIDER MYSELF NO CITIZEN OF THE U.S.A. I SPEND 40 MINUTES AT THE EMBASSY BEFORE SNYDER SAYS "NOW UNLESS YOU WISH TO EXPLOD ON YOUR MARXIST BELIEFS YOU CAN GO" I WISH TO DISSOLVE U.S. C.I.T., NOT TODAY HE SAYS IN EFFECT. I LEAVE EMBASSY ELATED AT THIS SHOWDOWN, RETURNING TO MY HOTEL I FEEL NOW MY ENORGIES ARE NOT SPENT IN VAIN. I'M SURE RUSSIANS WILL EXALT ME AFTER THIS SIGN OF MY FAITH IN THEM. ZOO ARNOCK, A REPORTER BY THE NAME OF GORSTENG WANTS AN INTERVIEW I'M FIERCELY Gassed & HOW DID YOU FIND OUT? THE EMBASSY CALLED U.S. HE SAID. I SENT HIM AWAY I STAND RELEZE THIS IS ONE WAY TO BRING PRESSURE ON ME. BY NOTIFYING MY RELATIONS IN U.S. THROUGH THE NEWSPAPERS, ALTHOUGH THEY WOULD SAY "IFS FOR THE PUBLIC RECORD." A HALF HOUR LATER ANOTHER REPORTER MISS MOSBY COMES. I ANSWER A FEW QUICK QUESTIONS AFTER REFUSING AN INTERVIEW. I AM SURPRISED AT THE INTEREST. I GET PHONE CALLS FROM "TIME" AT NIGHT A PHONE CALL FROM THE STATES I REFUSE ALL CALLS WITHOUT FINDING OUT WHO'S IT FROM. I FEEL NON-DEPRESSED BECAUSE OF THE ATTENTION 10:00 I RETIRE.

NOV. 1 - MORE REPORTERS, 3 PHONE CALLS FROM BRITISH MOTHER, NOW I FEEL SLIGHTLY ANXIATED, NOT SO ONLY.

NOV-2-15 DAYS OF UTTER LONELINESS, I REFUSE ALL REPORTS PHONE CALLS I REMAINE IN MY ROOM, I AM RACKED WITH DYSMORIA

NOV 15 - I DECIDE TO GIVE AN INTERVIEW, I HAVE MISS MOSBY'S CARD SO I CALL HER. SHE DRIVES RIGHT OVER. I GIVE MY STORY; ALLOW PICTURES, LATER STORY IS DISTORTED, SENT WITHOUT MY PERMISSION, THAT IS; BEFORE I EVER SAW AND CHECKED HER STORY, AGAIN I FEEL SLIGHTLY BETTER BECAUSE OF THE ATTENTION

NOV. 16. A RUSSIAN OFFICIAL COMES TO MY ROOM ASKES HOW I AM. NOTIFIES ME I CAN REMAINE IN USSR TILL SOME SOLUTION IS FOUND WITH WHAT TO DO WITH ME, IT IS COMFORTING NEWS.

SEE  
NOV  
15TH  
INTERVIEW

D. ARY.

PAGE 5

NOV 17 - DEC 30 I HAVE BOUGHT MYSELF TO SELF-TEACHING  
RUSSIAN LAM. BOOKS I FORCE MYSELF TO STUDY 4 HOURS A DAY  
I SIT IN MY ROOM AND READ AND MEMORIZE WORDS. ALL MEALS  
I TAKE IN MY ROOM. RIMMA ARRANGED THAT IT IS VERY  
COLD ON THE STREETS SO I HARLEY GO OUTSIDE AT ALL FOR THIS  
MONTH AND A HALF I SEE NO ONE SPEAK TO NO ONE ACCEPT EVERYBODY.  
AND THAN RIMMA, WHO CALLS THE MINISTRY ABOUT ME. HAVE THEY  
FORGOTTEN? DURING DECEMBER I PAID NO MONEY TO THE HOTEL, BUT  
RIMMA DID HOTEL I WAS EXPORTING A LOT OF MONEY FROM U.S.A. & I HAVE  
28. LEFT. THIS MONTH I WAS CALLED TO THE PASSPORT OFFICE AND  
MET 3 NEW OFFICIALS WHO ASKED ME THE SAME QUESTIONS I HAD.  
A MONTH BEFORE. THEY APPEAR NOT TO KNOW ME AT ALL.

DEC 31. NEW YEAR, EYE I SPEND IN THE COMPANY OF PESA ABRAHAMOVA  
AT THE HOTEL BERLIN, SHE HAS THE DUTY. I SIT WITH HER  
UNTIL PAST MIDNIGHT, SHE GIVES ME A SMALL 'BORATIN' DOWN,  
FOR A NEW YEARS PRESENT SHE IS VERY NICE I FOUND OUT  
ONLY RECENTLY SHE IS MARRIED, HAS SMALL SON WHO WAS BORN  
CRIPPLED, THAT IS WHY SHE IS SO STRANGELY TENDER AND COMPELING.

JAN 1 - 4 NO CHANGE IN ROUTINE

JAN I AM CALLED TO PASSPORT OFFICE AND FINALLY GIVEN A SOVIET  
DOCUMENT NOT THE SOVIET CITIZENSHIP AS I SO WANT, ONLY  
A RESIDENCE DOCUMENT, NOT EVEN FOR FOREIGNERS BUT A PAPER  
CALLED "FOR THOSE WITHOUT CITIZENSHIP". STILL I AM LEAVING.  
THE OFFICIAL SAYS THEY ARE SENDING ME TO THE CITY OF MINSK.  
I ASK "IS THAT IN BELARUS? NO, MINSK. HE ALSO TELLS ME  
THAT THEY HAVE ARRANGED FOR ME TO RECEIVE SOME MONEY  
THOUGH THE RED CROSS TO PAY MY HOTEL ETC AND EXPENSES.  
I THANK THE GENTLEMEN AND LEAVE LATER IN THE  
AFTERNOON I SEE RIMMA 'SHE ASKS ARE YOU HAPPY?' 'YES'

JAN 5. I GO TO RED CROSS IN MOSCOW FOR MONEY WITH INTERVIEWER  
(NEW ONE) I RECEIVE 5000 RUBLES PHASE II!! LATER IN  
MOSK I AM TO EARN 50 RUBLES A MONTH AT THE FRIDAY.

JAN 7. I LEAVE MOSCOW BY TRAIN FOR MINSK BELORUSSIA,  
MY HOTEL WILL BE MOSKOW, RUBES & LATER I WANT TICKET  
TO MINSK ETC. I WILL GO TO THE PART OF MOSCOW I WANT.  
I WANT TO PRODUCE A NOTICE LETTERS IN WHICH I SAID  
"I DO NOT WANT TO STAY HERE THAT YOU HAD TO SAY BEGINNING  
SOMEONE LIKE ME... IT WAS NOT ONLY PART OF THE OLD."



DIARY

Minsk

PAGE 6

-35-

JAN. 2. ARRIVE IN MINSK, MET BY 2 WOMEN RED CROSS WORKERS. WE GO TO HOTEL "MINSKY" I TAKE ROOM, AND MEET ROSA AND STELLINA. TWO PERSONS FROM INDIANIST IN HOTEL WHO SPEAK ENGLISH STELLINA IS IN 40'S NICE MARRIED YOUNG CHILD, ROSA ABOUT 23 BLOND ATTRACTIVE UNMARRIED EXCELLENT ENGLISH, WE ATTRACT EACH OTHER AT ONCE.

JAN. 8. I MEET THE CITY MAYOR, COMANDE SHARPOF. WHO WELCOMES ME TO MINSK PROPOSES A RENT-FREE APARTMENT "EVEN" AND WARRS ME ABOUT "HANDICAPPED PERSONS" WHO SOMETIMES INSULT FOR ENGLISH MY INTERPRETER: ROMAN DETKOF. HEAD FOR. TEL. INST. NEXT DOOR.

JAN. 10. THE DAY TO MYSELF I WALK THROUGH CITY, VERY NICE.

JAN. 12. I VISIT MINSK RADIO FACTORY WHERE I SHALL WORK.

THERE I MEET ARGENTINIAN IMMIGRANT ALEXANDER ZEGER BORN A POLISH JEW. IMMIG. TO ARGEN. IN 1938 AND DROVE TO

POLISH HOMELAND (NOW PART OF BELG.) IN 1955 SPEAKS

ENGLISH WITH AMER. ACCENT HE WORKED FOR AMER. COM. IN

ARGEN. HE IS HEAD OF A DEPT. A QUALIFIED ENGINEER, IN LAT.

WAS WELL MARRIED LIKE ME HE SEEMS TO WANT TO TELL ME SOMETH.

I SHOW HIM MY TEMPOR. DOCU. AND SAY SOON I SHALL HAVE RUSS. CITIZ.

JAN. 13. I WORK AS A "CHECKER" METAL WORKER, PAY: 700 RUB.

THE WORK VERY EASY I AM LEARNING RUSSIAN QUICKLY.

NOW, EVERYONE IS VERY FRANKLY AND KIND. I MEET MANY YOUNG

RUSSIAN WORKERS MY OWN AGE THEY HAVE VARIOUS PERSONALITIES

ALL WISH TO KNOW ABOUT ME EVEN OFFER TO HOLD A MASS MEETING

SO I CAN SAY. I REFUSE POLITELY. AT NIGHT I TAKE ROSA TO

THE THEATER, MUSIC IS PLAYED ABOUT EVERY DAY. I'M ENJOYING

DIG AND AM VERY SATISFIED. I RECEIVE A CHECK FROM THE

RED CROSS EVERY 5TH OF THE MONTH "TO HELP". THE CHECK IS 700 RUBLES.

THEREFORE EVERY MONTH I MAKE 1400 R. ABOUT THE SAME AS THE

DIRECTOR OF THE FACTORY! ZEGER CASEWORKER DURING THIS TIME

IS CONTINUING; PICTURE OF LENIN WHICH WATCHES FROM IS PLACED

HOROCAR AND PHOT. TAKING AT 11-110 EACH MORNING. (COMPLAUSERY)

FOR ALL (SHADES OF H.G. WELLS!!)

MARCH 14. I RECEIVE A SMALL FIRST ONE-ROOM APARTMENT

NEAR THE FACTORY (8 MIN. WALK) WITH SPLENDID VIEW FROM

2 BALCONIES OF THE RIVER. ALMOST RENT FREE (60. RUB A MONTH)

IT IS A RUSSIAN DREAM.

MARCH 17 - MARCH 21. - WORK, I HAVE LOST CONTACT WITH

ROSA AFTER MY HOUSE MOVING. I MEET PHIL GOLGUACH.

A YOUNG MAN MY AGE FRIENDLY VERY INTELLIGENT A

EXAMINER RADIO TECHNICIAN HIS FATHER: GEN. GILGOLACH

COMMANDED NORTH INDEPENDENT SIBERIA. TWICE HERO OF

USSR IN W.W. II.



## DIARY PAGE 7

MAY 1 - MAY DAY CAME AS MY FIRST HOLIDAY ALL FACTORIES ETC. CLOSED AFTER SPECTACULAR MILITARY PARADE ALL WORKERS PARADED FIRST REVIEWING STAND WAVING FLAGS AND PICTURES OF MR. K. ~~ETC.~~ ETC. I FOLLOW THE AMER. CUSTOM OF MARKING A HOLIDAY BY SLEEPING IN IN THE MORNING. AT NIGHT I VISIT WITH THE ZEGERS DAUGHTERS AT AN PARTY THROWN BY THEM ABOUT 45 PEOPLE COME MANY OF ARGENTINE ORIGIN WE DANCE AND PLAY AROUND AND DRINK UNTIL 2 AM. WHEN PARTY BREAKS UP. LEONARA ZELER ONEST DAN. 26 FORMALLY MARRIED, NOW DIVORCED, A TALENTED SINGER. ANITA ZELER 20 VERY GRAY, NOT SO ATTRACTIVE BUT WE MIX IT OFF. HER BOY-FRIEND ALFRED IS A HUNGARIAN CHINA, SILENT AND BLOODING, NOT AT ALL LIKE ANITA. ZELER ADVISES ME TO GO BACK TO USA. ITS THE FIRST VOICE OF OPPOSITION I HAVE HEARD. I RESPECT ZELER, HE HAS SEEN THE WORLD. HE SAYS MANY THINGS, AND RELATES MANY THINGS I DON'T KNOW ABOUT THE U.S.S.R. I BEGIN TO FEEL UNEASY INSIDE, ITS THERE!

JUNE-JULY SUMMER MONTHS OF GREEN BEAUTY, A FINE FOREST VERY DEEP. I ENJOY MANY SUNDAYS IN THE ENV. ORMENTS OF MINST. WITH THE ZELERS WHO HAVE A CAR "MOS. WICH" ALFRED ALWAYS GOES ALONG WITH ANITA. LEONARA SEEMS TO HAVE NO PERMITTED BOY-FRIEND BUT BARRY ADMIRING. SHE HAS A BEAUTIFUL SPANISH FIGURE LONG BLACK HAIR, LIKE ANITA. I NEVER PAY MUCH ATTENTION TO HER SHE'S TOO OLD FOR ME SHE SEEMS TO DISLIKE MY LACK OF ATTENTION. FOR SOME REASON, SHE'S ALMOST STRUNG. I HAVE BECOME HABITUATED TO A SMALL CAFE WHICH IS WHERE I DINE IN THE EVENING. THE FOOD IS GENERALLY POOR AND ALWAYS EXACTLY THE SAME, EVEN IN MY CAFE AT ANY POINT IN THE CITY. THE FOOD IS CHEAP AND I DON'T REALLY CARE ABOUT QUALITY AFTER THREE YEARS IN THE U.S.A.

AUG-SEPT AS MY RUSSIAN IMPROVES I BECOME INCREASINGLY CONSCIOUS OF JUST WHAT SORT OF A SOCIETY I LIVE IN. MASS GYMNASTICS, COMPULSORY AFTERWORK MEETING, MONTHLY POLITICAL INFORMATION MEETING. COMPULSORY ATTENDANCE AT LECTURES AND THE SENDING OF THE ENTIRE SHOP COLLECTIVE (EXCEPT ME) TO PICK POTATOES ON A SUNDAY, AT A STATE COLLECTIVE FARM. A PARADOXICAL DUTY TO BRING IN THE HARVEST. THE OPINIONS OF THE WORKERS (UNVOICED) ARE THAT ITS A GREAT PAIN IN THE NECK. THEY DON'T SEEM TO BE ESPECIALLY ENTHUSIASTIC ABOUT ANY OF THE "COLLECTIVE" ASIDES THAT ARE BEING FANDED (INCREASINGLY) AWARE OF THE PRESENCE, I WOULD THINK, OF LEEZEN, SHOP PARTY SECRETARY. FAR EXISTING. A JOVIAL ON THE OUTSIDE. HE IS A NO-SENSE PARTY REGIMINE.

DIARY

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at the coming of Fall, my friend OF A NEW RUSSIAN WINTER ARE ALLOWED IN SPENDID GOLS AND REDS OF FALL IN BELORUSSIA. THESE FRUITS APPLES AND CHERRYS ABOUND FOR THESE LAST FOUR WEEKS I AM A HEALTHY BROWN COLOR AND STUFFED WITH FRESH FRUIT. (AT OTHER TIMES OF THE YEAR UNOBTAINABLE)

C.E. IF MY 21<sup>ST</sup> BIRTHDAY GETS ROSA, PAUL, ELLA ~~AND~~ ~~AT~~ AT A SMALL PARTY AT MY PAPER, ELLA A VERY ATTRACTIVE RUSSIAN GIRL I HAVE BEEN GOING WALKING WITH LATIY, WORKS AT THE PAPER FACTORY AND ROSA AND ELLA ARE JEALOUS OF EACH OTHER IT BRINGS AN UNWANT FEELING TO ME. BOTH ARE AT MY DISK FOR THE FIRST TIME. ELLA AND PAUL BOTH GIVE ME SH-TRAYS (I DON'T SMOKE) WE HAVE A MOUTH

NOV. FINDS THE APPROACH OF WINTER NOW. AGROWING LONGNESS CREATES ME IN SPITE OF MY CONQUEST OF EMNATACHINA A GIRL FROM RIGA STUDYING AT THE MUSIC CONSERVATORY IN MINSK. ~~BUT AFTER AN AFFAIR WHICH LAST A FEW WEEKS WE PART.~~

NOV. I MAKE THE ACQUAINTANCES OF FOUR GIRLS ROOMING AT THE CON. LON. DORMITORY IN ROOM 212. NEEL IS VERY INTERESTING, SO IS TIMKA, TOM'S AND ALMA. I USUALLY GO TO THE INSTITUTE DORMITORY WITH A FRIEND OF MINE WHO SPEAKS ENGLISH VERY WELL. EKALIT. YOU IS IN THE FORTH YEAR AT THE MEDICAL INSTITUTE. VERY BRIGHT FELLOW

AT THE DORMITORY WE GO SIT AND TALK FOR HOURS IN <sup>ENGLISH</sup> ~~RUSSIAN~~ I AM HAVING A LIGHT AFFAIR WITH NEEL KOROBKA.

JAN. 1. NEW YEARS I SPEND AT HOME OF ELLA GERMAIN. I THINK I AM IN LOVE WITH HER. SHE HAS REFUSED MY MORE DISHONOURABLE ADVANCES, WE DRINK AND EAT IN THE PRESENCE OF HER FAMILY IN A VERY PLEASANT ATMOSPHERE LATER I GO HOME GRATE AND HAPPY. PASSING THE RIVER HOMEWARDS, I DECIDE TO PROPOSE TO ELLA.

JAN. 2. AFTER A PLEASANT PARTISAN-WALK TO THE LOCAL COUNTRY WE COME HOME, STANDING IN THE LOCKSTEP I PROPOSE'S SHE HESITATES THEN REFUSES, MY LOVE IS REAL BUT SHE HAS NOSE FOR ME, HER REASON BESIDES LACK OF LOVE, I AM AMERICAN AND SOMEBODY MIGHT BE ARRESTED EMPLOY. BECAUSE OF THAT EXAMPLE POLISH INTERVENTION IN THE 20'S. DID TO ARREST IF ALL PEOPLE IN THE POLISH UNION OF POLISH ORIGIN "YOU UNDERSTAND THE WORLD SITUATION THERE IS TOO MUCH AGAINST YOU AND YOU DON'T EVEN KNOW IT" I AM STUNNED ~~AND~~ SMILES AT MY WORKERS IN TRYING TO GO I AM TOO STUNNED (TOO THINK) I REALIZE SHE WAS FINE, ALONG WITH ME BUT ONLY EXPLOITED MY BEING AN AMERICAN IN ORDER TO GET THE END OF THE OTHER GIRL WHO CONSIDERS ME DIFFERENT FROM THE RUSSIAN BOYS. I AM MISERABLE!

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DAILY

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JAN 3. I AM MISERABLE ABOUT ELLA. I LOVE HER BUT WHAT CAN I DO?

JAN 4. IT IS THE STATE OF ~~FEAR~~ WHICH WAS ALARM IN THE SILENT UNION. ONE YEAR AFTER I RECEIVED THE RESIDENCE DOCUMENT I AM CALLED IN TO THE PASSPORT OFFICE AND ASKED IF I WANT CITIZENSHIP (RUSSIAN); I SAY NO SIMPLY EXTEND MY RESIDENTIAL PASSPORT TO AGREE AND MY DOCUMENT IS EXTENDED UNTIL JAN 4. 1962.

JAN 4-31 I AM STARTING TO RECONSIDER MY DESIRE ABOUT STAYING THE WORK IS DUMB THE MONEY I GET HAS NOWHERE TO BE SPENT. NO LEISURE TIMES OR BUILDING DAYS NO PLACES OF RECREATION ABOUT THE TRADE UNION OFFICES I HAVE MADE HARD ENOUGH.

FEB. 15 I MAIL MY FIRST REQUEST TO AMERICAN EMBASSY, MOSCOW FOR RECONSIDERING MY POSITION, I STATED "I WOULD LIKE TO GO BACK TO THE U.S."

FEB. 28 I RECEIVE LETTER FROM EMBASSY. RICHARD E. STAYEGGER STATES "I COULD COME IN FOR AN INTERVIEW ANY TIME I WANT." MARCH 1-15 I NOW LIVE IN A STATE OF EXPECTATION ABOUT GOING BACK TO THE U.S. I CONFIDED WITH ZEGGER HE SUPPORTS MY JUDGMENT BUT WARNS ME NOT TO TELL ANY RUSSIANS ABOUT MY DESIRE TO RETURN. I UNDERSTAND NOW WHY.

MARCH 17 - I AND ERIN WENT TO TRADE UNION DANCE. BOILING BUT AT THE LAST HOUR I WAS INTRODUCED TO A GIRL WITH A FRENCH SMILE-DE AND RED-DRESS WITH WHITE SLIPPERS. I DANCED WITH HER. THEN ASK TO SHOW HER HOME I DO ALONG WITH 5 OTHER ADMIRERS HER NAME IS ANNA. WE LIKE EACH OTHER. RIGHT AWAY SHE GIVES ME HER PHONE NUMBER AND LEAVES HOME WITH AN ANOTHER NEW FRIENDS IN A TAXI. I WALK HOME.

MARCH 18-31 - WE TALK & TALK A LITTLE ABOUT MYSELF. SHE TALKS A LOT ABOUT HERSELF. HER NAME IS IRINA N. PRASAKOVA.

APRIL 1-30 WE ARE GOING STEADY AND I DECIDE I MUST LEAVE HER, SHE PUTS ME OFF SO ON APRIL 15 I PROPOSE SHE ACCEPTS.

APRIL 31, AFTER A 7 DAY DELAY AT ITS MAGAZINE BECAUSE

BECAUSE OF MY UNUSUAL PLEASANT IT IS ALLOW US TO REGISTER AS MAN & WIFE TWO OF MY FRIENDS GIRL FRIEND AS AN INTERMEDIATE, WE ARE MARRIED. AT HER HOME HOME WE HAVE A HOME, RECEPTION FOR ABOUT 20 FRIENDS & NEIGHBORS WHO WISH US HAPPINESS (IN SPIRIT OF MY SISTER AND ACCEPT) WHICH WAS AN UNEXPECTED SURPRISE, INVITING TO MY SISTER'S HOME FOR THE VERY FIRST TIME IN THE SOVIET UNION. AFTER THAT

ON EVENING OF EXCITING & DRUNKEN, IN WHICH WIFE MOOSER STARTED A FIGHT & THE FIGHT FLOW ON AN UNLOADING CIRCUIT WE TOOK OUR LEAVE AND WALK THE 15 MINUTES TO OUR HOME. WE LIVED MORE SOON, OTHER. AT MIDNIGHT WE WERE HOME.



## DIARY PAGE 10

MAY DAY 1961. FOUND US THINKING ABOUT OUR FUTURE IN THE  
OF FACT I MARRIED MARINA TO MARY ELIA I FOUND MYSELF  
IN LOVE WITH MARINA.

MAY - THE TRANSITION OF CHANGING FULL LOVE FROM ELIA  
TO MARINA WAS VERY PAINFUL ES. AS I SAW ELIA ALMOST  
EVERY DAY AT THE FACTORY BUT AS THE DAYS WENT BY  
I ADJUSTED MORE AND MORE MY WIFE MENTALLY. I STILL  
HARDLY TALK MY WIFE OF MY DESIRE TO RETURN TO U.S.  
SHE IS MADLY IN LOVE WITH ME FROM THE VERY START.  
BOAT RIDES ON LAKE MINSK WALKS THROUGH THE PARKS  
EVENING AT HOME OR AT MUNT VALIA'S PLACE MARK MAY

JUNE - A CONTINUENCE OF MAY, EXCEPT THAT WE DRAW CLOSER  
AND CLOSER AND I THINK VERY LITTLE NOW OF ELIA.

IN THE LAST DAYS OF THIS MONTH I REVELE MY LONGING  
TO RETURN TO AMERICA. MY WIFE IS SLIGHTLY STARTLED  
BUT THEN ENCOURAGES ME TO DO WHAT I WISH TO DO.

JULY - I DECIDE TO TAKE MY TWO WEEK VACATION  
AND TRAVEL TO MOSCOW (WITHOUT POLICE PERMISSION)  
TO THE AMERICAN EMBASSY TO SEE ABOUT GETTING MY U.S.  
PASSPORT BACK AND MAKE ARRANGEMENTS FOR MY WIFE  
TO ENTER THE U.S. WITH ME.

JULY 8 - I FLY BY PLANE TO MINSK ON A IL-20, 2:45-3:00  
LATER AFTER TAKING A TEARFUL AND ANXIOUS PARTING FROM  
MY WIFE I ARRIVE IN MOSCOW DEPARTING BY BUS  
FROM THE AIRFIELD I ARRIVE IN THE CENTER OF THE  
CITY. MAKING MY WAY THROUGH HEAVY TRAFFIC I  
DON'T COME IN SIGHT OF THE EMBASSY UNTIL 3:00 IN  
THE AFTERNOON. ITS SATURDAY WHAT IF THEY ARE  
CLOSED? ENTERING I FIND THE OFFICES EMPTY BUT  
MANAGE TO CONTACT SVYER ON THE PHONE (SINCE ALL  
EMBASSY PERSONAL LIFE IN THE SAME BUILDING)  
HE COMES DOWN TO MEET ME SHOWS MY HAND AFTER  
INTERVIEW HE ADVISES ME TO COME IN FIRST THING MON.  
(see - July 8-13.)

JULY 8 - INTERVIEW JULY 9 RECEIVE PASSPORT. CALL MARINA TO MOSCOW ALSO.

JULY 14. I AND MARINA RETURN TO MINSK.

JULY 15. MARKING AT WORK, IS SHOCKED TO FIND OUT THEY  
EVERYONE KNOWS SHE ENTERED THE U.S. EMBASSY. THEY WERE  
CALLED AT HER PLACE OF WORK FROM SOME OFFICIAL IN MOSCOW.  
HE ASKS HOW A MEETING AND GIVE HER A STAMP.  
BROWSBERTING. THE FIRST OF MANY STAMPS.



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W. H. H. Third Page

JULY 15 AUG 10. WE HAVE FOUND OUT WHICH STAMPS AND CERTIFICATES ARE NECESSARY ~~FOR~~ TO APPLY FOR A EXIT VISA THEY NUMBER ABOUT 20 PAPER, BIRTH CERTIFICATES AFFIDAVIT MARRIAGE. ON AUG 20<sup>th</sup> we give the papers out they say it will be 3 1/2 months before we know whether they let us go or not. in the meantime MARRIA HAS HAD TO STAY & DIFFICULT MEETING AT THE PLACE OF WORK HELD BY HER BROTHER AT THE DIRECTION OF "SOMEONE" by phone. The young com. leave headquarters also called. About Jan or Feb had to go see them for 1 1/2 hrs. The purpose (expressed) is to dissuade her from going to the army. NEVERTHELESS MAKE HER MORE SURE ABOUT WINNING DO. MARRIA IS DETERMINED. WE ONLY HOPE THAT THE VISAS COME THROUGH SOON.

AUG 21- SEPT 1. I MAKE EXPEDITED TRIPS TO THE PASSPORT & VISA OFFICE ALSO TO MINISTRY OF FOR. AFFAIRS IN MINSK, ALSO MIN. OF INTERNAL AFFAIRS, ALL OF WHICH HAVE A SAY IN THE GRANTING OF A VISA. I EXTRACTED PROMISES OF QUICK ATTENTION TO US.

SEPT- OCT 18. NO WORD FROM MINSK. (THEY'LL CALL US)

MARRIA LEAVES MINSK BY TRAIN ON VACATION TO THE CITY OF KHARKOV IN THE UKRAINE TO VISIT AN AUNT for 2 weeks. DURING THIS TIME I AM LONELY BUT I AND ERICH GO TO THE PARKS AND PUBLIC PLACES FOR ENTERTAINMENT. I WANT NONE THIS IN QUITE A FEW MONTHS NOW.

I SPEND MY BIRTHDAY ALONE AT THE OPERA WORKING MY FINGER OF "QUEEN OF SPADES." I AM 22 years old.

NOV 2. MARRIA ARRIVES BACK, RADIANT, WITH SEVERAL STARS OF PRESENCE FOR ME FROM HER AUNT & UNCLE.

NOV-DEC. NOW WE ARE BEGINNING THINK ABOUT THE RAILWAY. MARRIA IS BEGINNING TO WONDER ABOUT GOING TO THE U.S. PROBABLY FROM THE STRAIN AND HER BEING PREGNANT STILL WE GUARD AND SO THINGS ARE NOT TO BRING DESP. WITH THE APPROACH OF THE HARD RUSSIAN WINTER.

DEC 25<sup>th</sup> ~~TO~~ WITH DAY TUES. MARRIA IS CALLED TO THE PASSPORT & VISA OFFICE. SHE IS TOLD WE HAVE BEEN GRANTED SOME OF THE VISA. SHE HAS SET THE COMPLETING RAILROAD AND THEN COME HOME WITH THE ISSUE OF GREAT (I THINK) NEW PAPER. WE STAY AT THE 2nd FLOOR AT A DINNER PARTY AT MIDNIGHT. DURING MY OTHER FAREWELL.

JAN 4. I AM CALLED TO THE PASSPORT OFFICE SINCE MY RESIDENTIAL PASSPORT EXPIRES TODAY. SINCE I DON'T HAVE A U.S. PASSPORT IN MY POSSESSION I MUST GO TO THE NEW RESIDENCE OFFICE. THEY HAVE GIVEN US A NEW PASSPORT SINCE THE OLD ONE WAS TAKEN AWAY TO JULY 1962.

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Jan 15-  
Feb 15

maxima is supposed to have been on March 12.

1891. 5

1890

Feb

7

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you

Mr. A.

1874

APRIL -

(17) November 3, 1959. Declaration requesting revocation of United States citizenship, signed Lee Harvey Oswald. Purple ink; nib pen.

Communist Party of the United States

Nov. 3, 1959

I, Lee Harvey Oswald, do hereby request that my present United States citizenship be revoked.

I appeared in person, at the consulate office of the United States Embassy, Moscow, on Oct 31<sup>st</sup>, for the purpose of signing the formal papers to this effect. This legal right I was refused at that time.

I wish to protest against this action, and against the conduct of the official of the United States consular service who acted on behalf of the United States government.

My application, requesting that I be considered for citizenship in the Soviet Union is now pending before the Supreme Soviet of the U.S.S.R..

In the event of acceptance, I will request my government to lodge a formal protest regarding this incident.

Lee Harvey Oswald



(18) November 15, 1959. Photocopy of handwritten account of interview with Miss Aline Mosby, UPI Reporter.

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D. HAY

INTERVIEW  
WITH MISS MOSBY NOV. 15, 1959

MISS MOSBY: ANTENNA greets me and sits down  
I START BY SAYING. I wish it understood that I wish to  
SEE THE STORY BEFORE IT IS SENT. "AN Right" she says "IT'S ALL  
THE SAME TO ME WHAT YOU DO IN REGARDS TO YOUR LIFE,  
IT'S JUST TAKING DOWN YOUR WORDS." O.K. I SAY, FIRST THE  
REASONS FOR MY COMING. SHE ASKS ABOUT MILITARY SERVICE  
I ANSWER QUESTIONS ABOUT MY MILITARY SERVICE AND THEN  
YOU SHE ASKS WHY DID YOU APPLY FOR SOVIET CITIZENSHIP,  
WHAT ARE YOUR REASONS FOR COMING HERE? I HAVE WAITED  
FOR TWO YEARS IN ORDER TO DISCLOSE MY AMERICAN  
CITIZENSHIP I HAVE BEEN TOO MUCH LATE AND INJUSTICE  
IN THE U.S. I HAD SERVED IN THE OCCUPATION FORCES  
IN JAPAN AND OCCUPATION OF A COUNTRY IS IMPERIALISM,  
WHAT THE RUSSIANS WOULD CALL "IMPERIALISM" I HAVE  
CHOSEN A SOCIALIST COUNTRY SINCE THERE ARE ONLY TWO  
MAIN SYSTEMS IN THE WORLD, "WHY THE U.S.A." she asks  
"WHY NOT CUBA OR VIETNAM, WHERE THE HOUSING PROBLEM IS  
NOT SO BAD" I HAD CHOSEN THE U.S.A. SINCE IT WAS  
THE LEADER OF THE SOCIALIST CAMP. AND THE SYMBOLIC  
CHAMPION OF THE CAUSE OF COMMUNISM. "WHAT OTHER  
REASONS LEAD YOU TO CHANGE YOUR LOYALTY." "IN THE  
U.S., AS WE KNOW, THERE ARE MANY SHORTCOMINGS, RACIAL  
SEGREGATION AND THE REPRESSION OF THE UNDER DOG, E.C.S.  
COMMUNIST PARTY. HOW LONG HAVE YOU BEEN STUDYING  
MARXISM." I FIRST STARTED STUDYING "MAYBE WHEN  
I WAS 15." "I ALWAYS HAD TO DIG FOR MY BOOKS IN  
THE BACK, DUSTY, SHELF OF LIBRARY AND OLD AUTOMATED  
BOOKS WERE THE BACK BOND OF MY READING, LOOKS ON  
PHILOSOPHY, POLITICAL ECONOMY ETC." "IN MY LIBRARY IN  
THE MOST OBVIOUS PLACES THERE WERE THE PROMINENT  
ANTI-COMMUNIST BOOKS WE KNOW SO WELL BUT AS  
I SAY I ALWAYS HAD TO DIG FOR MY BOOKS "WHAT  
WERE SOME IMPRESSIONS YOU GOT SERVING IN THE OCCUPATION  
FORCES" I SAW THE AMERICAN MILITARY TANKING COMING  
UP A MOUNTAIN AHEAD, THE TOOL OF WAR AND OPPRESSION I  
HAD TO LEAVE THE U.S. IMPERIALIST MILITARY. "HOW DO YOU SEE

HANDWRITTEN ACCOUNT OF INTERVIEW WITH MISS MOSBY, UPI REPORTER,  
FOUND AMONG OSWALD'S PERSONAL EFFECTS.  
(OSWALD'S HANDWRITING)



(19) 1960, undated. Political discussion, handwritten on stationery of the Holland-American Line; 15 pages.



Holland-America Line

I have often wondered why it is that  
the communist <sup>and even the</sup> ~~corrupted~~ <sup>and uncorrupted</sup> ~~movement~~ and even the  
first elements in our own country  
profess patriotism toward the land  
and the people, if not the government  
although their <sup>movements</sup> ~~will~~ next surely  
lead to the little destruction of all  
and everything.

I am quite sure that people must  
hate not only the government but  
the ~~the~~ <sup>the</sup> culture, ~~traditions~~ <sup>traditions</sup>, heritage  
and very people itself, and yet they  
stand up and proudly pronounce themselves  
patriots, displaying their war medals, the  
they gained in conflicts ~~between~~ <sup>between</sup>  
between themselves.

I wonder what would happen if somebody  
was to stand up and say he was utterly  
opposed not only to the government, but to the  
people, to the entire land and complete  
foundations of his society.



RMS

2

*United America Live*

I have heard and read of the resurgence of americanism in the US, not the ultra-right type, but rather the polite, seemingly pointless americanism expressed by such as the "american fore group" ~~and its~~ <sup>and its</sup> foundation.

and yet even in these veiled, domestic, patriotic gestures, there is the obvious "safe being ground" by the ~~domestic~~ <sup>domestic</sup> interests of the sponsors of these expensive undertaking.

To where can ~~the~~ <sup>it</sup> turn? to factional mutants of both systems, to old ball ~~foreign~~ <sup>foreign</sup> idealists out of touch with reality. to religious groups. to revisionists or to absurd anarchists. no!

any person knowing both systems and  
 their practical accessories, there can be  
 no distinction between the systems  
 as they exist to-day and what  
 person.

He must be opposed to their basic  
 foundations and representatives

and yet it is easier to take the  
 sort of attitude which says "a curse on  
 both your houses!"

there are two great representatives of  
 power in the world, simply expressed,  
 the left and right, and their <sup>positions</sup> ~~opposing~~  
 and conciliatory.

any practical attempt at one alternative  
 must have as its nucleus the traditional  
 best of both systems, and yet be utterly  
 opposed to both systems.

No new system can be entirely  
 new, that is where most ~~revolutionaries~~  
~~go astray~~ industrial or political, go  
 astray. And yet the new system must  
 be opposed unequivocally to the old, that  
 is where revolutions go astray.



4

the end of the century in America  
the energy of industrial revolution  
private enterprise triumphed  
it offered ~~it~~ a new,  
efficient and promising future while  
still observing the ~~and~~ idealistic  
democratic ideals of its overthrow  
predominant, <sup>T.C.</sup> ~~original~~ rural small  
enterprise.

and at about the same time in  
Tsarist Russia the aristocracy was  
overthrown by the peasants and workers  
and the road laid open for the going  
of power by the bolshewiks because they  
too, offered a bright new future without  
violating historical traditions of Russian  
working class life.

therefore in history there are many  
such examples of the nucleus of  
the new order rooted in the idealistic  
traditions of the old.

the industrial revolution ~~has~~  
its present atomic age and yet it has  
developed as a intricate part of its system  
its own shortcomings



R.M.S.

25

for instance  
 may be compared to the  
 which displays no money  
 value. It is obvious it is  
 away. rather it is the much  
 more subtle aspects of industrialization  
 and mechanization which bring the  
 greatest hardships upon the people  
 a general decay of classes into shapeless  
 societies without real cultural foundation,  
 regeneration; not so much of people  
 since industrialization actually provides  
 for more free movement of classes  
 around each other, but rather of ideals,  
 although those elemental ideals have  
 more freedom of expression throughout  
 all the classes.





FEB 2 1900

2

Holland House, London

Is that the old system of exchange  
even within itself is reversing and  
what is most evident, forming a new  
economic coalition, such as the common  
market.



in its communist experiment several  
 features and inevitable developments have  
 emerged, which Marx and Engels could not  
 possibly have foreseen. These emerge  
 with increasing clarity two major  
 mistakes which <sup>and</sup> ~~may be made~~ <sup>are made</sup> ~~not~~  
 mention the way for the state of  
 a free economic system. The doctrine of surplus  
 value which has developed <sup>is</sup> ~~has~~ <sup>been</sup> ~~is~~  
 unshakable and controversial.

The first mistake is fairly well known  
 even at this stage in the communist development  
 the "withering away of the state" <sup>as it was called</sup>  
~~communist~~ ~~doctrine~~ many emphasized  
 that the abolition of classes would lead  
 to the gradual reduction of state apparatus  
 however this is not its case and is better  
 observed than contemplated. The state rather  
 become more <sup>centralized</sup> ~~centralized~~ in that while the  
 powers of ministries or delegations they are  
 not reduced in the dividing of  
 organs of state power into smaller units  
 at lower levels as although the <sup>role</sup> ~~role~~  
 of state actually ~~disappeared~~ <sup>disappeared</sup> in <sup>some</sup> ~~some~~  
 they have become more <sup>centralized</sup> ~~centralized~~  
 than ever at lower levels this











R.M.S. 1<sup>A</sup>

Holland-America Line

There have already been a few organizations who have declared that they shall become effective only after conflict between the two world systems leaves its ~~world~~ country without defense or foundation of government, organizations such as the minute men for instance, however they intend are preparing to simply defend the present system and reinstate its influence after its mutual defeat of both systems mutually which is more or less taken for granted.

These mixed groups will represent the remaining hard core of fanatical American capitalist supporters.

There will undoubtedly be similar representations of this kind by communist groups in communist countries.

There will also be many divided religious segments of putting forward





ms. 25

Holland-America Line

their own alternatives and through  
larger memberships than the minute  
men set.

However there will also be overarched  
peaceful and quiet probably fascist ~~and~~  
splinter groups. However all these  
unlike the minute men and communist  
partisan groups, will be unarmed.

The mass of survivors ~~to~~ will  
probably however, will not be long  
too big of these groups. They will  
not be foolish enough to join  
extremes and will be too disaffected  
to support either the communists or  
the capitalist parties in their respective  
countries after ~~the~~ atomically.

They shall seek an alternative  
opposed to those systems which have  
brought them misery.

But their thinking and education



R.M.S. 37.

Holland America Line

will be steeped in the traditions of those systems they will never accept a "new order" complete beyond their understanding, <sup>any more than they would expect the</sup> logically, they would deem it necessary to oppose the old systems but <sup>expressly</sup> support at the same time ~~and~~ their cherished traditions.

I intend to put forward just such an alternative.

~~In the United States it would mean~~

In making such a declaration I must say that in order to make this alternative effective, supporters must prepare now ~~for this~~ in the event the situation presents itself for the practical application of this alternative.

in this way the <sup>militarist</sup> men and their narrow support of capitalisms have been most far-right, however they present only a <sup>suicidal</sup> ~~reaction~~ force whereas ~~in my alternative we would consist~~ what is needed is a <sup>small</sup> ~~practical~~ group of persons desiring peace.



R.M.S. 47

Holland-America Line

but stand fastly opposed to the  
reversal of forces who have led millions  
of people to death and destruction and  
in a dozen wars ~~that~~ and have now  
at this moment led the world  
into unsurpassed danger.

we have lived into a dark generation  
of tension and fear.

But how many of you have  
tried to find out the truth behind  
the cold war clitics!!

~~I~~ ~~to~~ ~~no~~ ~~one~~ having lived  
under both systems, I had sought  
the answers and although it  
would be very easy to delude myself  
into believing one system is better  
than the other, I know they are  
not.

I despise the representatives  
of both systems whether they  
be socialist or Christian democrats.  
Whether they be labor or conservative  
they are all products of the two systems.



(21) 1962, undated. Photocopy of document identified as a self-questionnaire. Original was stained and unsuitable for examination.

Exhibit 100

Exhibit (C) for identification

Q. MAY I GO TO THE USSR?

I acted as a critic of the U.S. (as a tourist) residing in a friendly country which I have a perfect right to do. I was there to see the land, its people and how their system works.  
I asked about China at the time? I made no better finding to U.S.!!  
In accordance with the U.S. Embassy I made no anti-communism  
and any criticism I might have had because of the lack of information  
of the U.S. State Department was lost. The U.S. Press & the

What about that tape recording? I made a recording for the  
the Bureau about Radio Times, in which I ~~talked~~  
spoke about night music and what I had seen in various  
towns. I expressed delight in all the interesting places  
I mentioned in this respect at University, wherever I was  
recording by saying, "The American I remember I heard this music  
1. Did you know Louis B. Bickel or taking work in the U.S.  
under the law a person may lose all protection of the U.S. by voting  
or serving in the armed forces of a foreign state or taking on  
the of allegiance to that state. I did none of these

2. Capital work: The LSSK considers state work?

and exclusively only plants working directly for the state  
secretly defense. ~~all~~ all other plants are owned by the  
workers who work in them.

[illegible]



116

sent it) so there wasn't much else I could  
 it. And I didn't expect that the story was ever  
 blown out of shape once it got into U.S. In England  
 the printed story was fabricated conscientiously.

6. why did you remain in the USSR for as long if you only

I resided in the USSR ~~until~~ until <sup>the</sup> Embassy, when I  
 asked the Embassy stating that I would like to go home  
 (my passport was at the Embassy for safekeeping) they  
 invited me to Moscow for this purpose however, it took  
 me almost 1/2 year to get a permit to leave the city of  
 Leningrad for Moscow. In this connection I had to go with  
 from the head consul to the Russian authorities in  
 (the Russians are very bureaucratic and slow about letting  
 foreigners travel about the country since the war.)

When I did get to Moscow the Embassy immediately gave  
 me back my passport and advised me as to how to  
 get a sputnik visa from the Russians for myself and  
 my Russian wife. This long and arduous process took  
 months from July 1962 until ——— 1962, through  
 you all almost 1 year was spent in trying to leave  
 the country. That's why I was there so long not only

7. are you a communist? Have you ever known a communist?

no of course not, I have never even known a communist  
 outside of the ones in the USSR but you can't help that.

8. What are the outstanding differences between the USA and USSR  
 freedom of speech travel interposition opposition to unequal  
 policies freedom to believe in god.

anyway, thank you and you are a real patriot!!

1. Q. Why did you go to the USSR?

A. I was as a matter of course and protest against American policies in foreign countries, my personal sign of dissatisfaction and down to the misguided line of reasoning of the U.S. Government. What about those letters? I made several letters in which I expressed my deep feeling to the American Embassy when in Oct. 1954 I went there to formally resign my American citizenship and was refused this legally right.

Q. Did you make statements against the U.S. there? A. Yes. Q. What about that type recording? I made a recording for Radio Moscow which was broadcast the following evening in which I spoke about the beautiful capital of the socialist world and all its progress.

2. Did you break laws by working or taking work in the USSR?

A. I did in that I took on other of citizens to the USSR.

3. Did all work in the USSR considered broke work? Yes of course and in that respect I also broke U.S. laws in accepting work under a foreign state.

4. What about statements you made to U.P.I. agent Mike...

I was approached by Mike Moskley and other reporters just after I had formally requested the American Embassy to legally designate my U.S. citizenship, for a story, they were notified by the U.S. Embassy, not by me. I answered questions and made statements to Mike Moskley in regard to my reasons for coming to the USSR, her story was warped by her later, but in brief essence it is possible to say she had the truth printed.

5. Why did you remain in the USSR for so long if you only wanted to...

A. I remained in the USSR from Oct. 10 1954 to spring of 1955 in period - 2 years. I did so because I was having quite comfortably and plenty of money, one apartment and few lots of girls etc. When asked I have all that?

6. Are you a communist? you ~~are~~ sincerely, although I hate the USSR and Soviet system I still think maybe I can work under different circumstances.

7. How can you ever become a communist? Not in the U.S.A.

1. Statement to report
2. 7. After to end a page
3. Types secondary to Radio Moscow
- 4.

1. Tourist Report de l'au. du Coll., notations - night and sounds  
extremely so log of events in notation called "musical notation" ~~original~~
2. asking for information about him to Director - 1549 ~~18~~ 18

8. What are the distinctive differences between the USSR and USSR?  
now, except in the ... the living standard is a little  
higher. ... medical aid and  
the ... is better than  
in the U.S.A.

(22) January 17, 1962. Affidavit of support, addressed to the American Embassy, Moscow, U.S.S.R., signed Lee H. Oswald.

American Embassy  
Moscow, U.S.S.R..

Lee H. Oswald  
Kalinina St.  
House 4, Apt. 24  
Minsk, U.S.S.R..  
January 17, 1962.

### affidavit of support

I, Lee H. Oswald, affirm that I have the ability and desire to support my wife, Marina N. Oswald, from such time as she shall become a resident of the U.S.A..

I have no obligations of support to any other person and I have no other debts, expenses or obligations to any firm or individual.

I am fully employable in the occupational fields of metals and electronics.

Plans have been made for my wife to reside with me in Vernon, Texas at the residence of my mother Mrs. M. Oswald.

Lee H. Oswald



(23) February 20, 1962. Russian script on lined paper, from "Alek" to "Marina" and "June".

Feb. 20

Дорогая Марина  
Надеюсь тебе чувствуюсь себе  
хорошо.

Как жизнь есть хорошо? <sup>(20.02)</sup>  
Сегодня, мы работаем в редакции  
собираем тебе деньги на подарок  
они потом передадут тебе подарок  
тетя. Вай Вайа у тебе сегодня  
или впр? и тетя Лина?

Я ей скажу что тебе надо  
милочка, надеюсь, что Майла.

Когда тебе отлучится?

Скороно все у Лизына?

Я Эмика и Олива Вида  
субботу в Оли Лина Кили  
мне тоже переписка.

Мы получили от Роберта  
письмо в котором он  
приглашал нас жить  
с ними когда тебе будет  
в сила.

Завтра, наверное, я не приду  
О.К.? Вайа Алек

(21) March 24, 1962. Entry papers of Marina Oswald, including a fingerprint identification card. (FBI Exhibit D-10)

RECEIVED UNITED STATES DEPARTMENT OF JUSTICE  
IMMIGRATION AND NATURALIZATION SERVICE  
NEW ORLEANS, LA.  
JUN 25 10 09 AM '63

Form approved  
Budget Bureau No. 41-2040.5  
26 JUN 1962

File No. A 12 530 645

\$ 1.00	<b>FEE PAID</b>	No. <u>63-246-1</u>
IMMIGRATION & NATURALIZATION SERVICE		
NEW ORLEANS, LOUISIANA INFO		
Date <u>6/25/63</u>	Verified by <u>[Signature]</u>	

To the District Director  
IMMIGRATION AND NATURALIZATION SERVICE

The undersigned, whose alien registration receipt number is A 12 530 645, hereby applies for a new alien registration receipt card.

1. ☐ (a) I am attaching the Form I-151 in my possession and desire a new card because ☐ my name has been changed ☐ the card is mutilated.
- ☐ (b) My alien registration receipt document was lost on or about April 1st 1963 under the following circumstances IN POSE IN STREET IN DALLAS, TEXAS, WHILE SHIPPING (Date)
- In case such receipt which was lost is recovered, or I ascertain its whereabouts, I will report the facts and will surrender such receipt or immigrant identification card to the Immigration and Naturalization office nearest my place of residence.

Present Name <u>MARINA N. OSWALD</u>		Present Nationality <u>RUSSIAN</u>	
Present address <u>mailing at - P.O. Box 30061 New Orleans, La.</u> <u>4007 LIE MAGAZINE ST NEW ORLEANS, LA.</u>			
Name at time of registration and fingerprinting <u>same</u>			
Name at time of lawful admission for permanent residence <u>same</u>			
Admitted at <u>Port of New York</u>	(city or town) <u>N.Y.</u>	(state) <u>N.Y.</u>	Date of admission <u>JUNE 13, 1962</u>
Means of travel or other means of conveyance <u>"MASS JAM" HOLLAND-AMERICAN</u>		Destination in U.S. at time of admission <u>FT. WORTH TEXAS</u>	
Birthdate <u>JULY 17 1944</u>	Birthplace <u>SPUDRO-DVENSK</u>	(city) <u>USSR</u>	(country) <u>USSR</u>
Dates of any absence from the U.S. for 1 year or longer, since lawful admission for permanent residence: <u>NONE</u> <u>21092790</u> <u>Full</u> <u>File</u> <u>W</u>			

I CERTIFY that the information above is true and correct to the best of my knowledge and belief.

For Statistics (Forms G-22.2a, G-22.2b, G-22.2c, G-22.2d, G-22.2e, G-22.2f, G-22.2g, G-22.2h, G-22.2i, G-22.2j, G-22.2k, G-22.2l, G-22.2m, G-22.2n, G-22.2o, G-22.2p, G-22.2q, G-22.2r, G-22.2s, G-22.2t, G-22.2u, G-22.2v, G-22.2w, G-22.2x, G-22.2y, G-22.2z, G-22.2aa, G-22.2ab, G-22.2ac, G-22.2ad, G-22.2ae, G-22.2af, G-22.2ag, G-22.2ah, G-22.2ai, G-22.2aj, G-22.2ak, G-22.2al, G-22.2am, G-22.2an, G-22.2ao, G-22.2ap, G-22.2aq, G-22.2ar, G-22.2as, G-22.2at, G-22.2au, G-22.2av, G-22.2aw, G-22.2ax, G-22.2ay, G-22.2az, G-22.2ba, G-22.2bb, G-22.2bc, G-22.2bd, G-22.2be, G-22.2bf, G-22.2bg, G-22.2bh, G-22.2bi, G-22.2bj, G-22.2bk, G-22.2bl, G-22.2bm, G-22.2bn, G-22.2bo, G-22.2bp, G-22.2bq, G-22.2br, G-22.2bs, G-22.2bt, G-22.2bu, G-22.2bv, G-22.2bw, G-22.2bx, G-22.2by, G-22.2bz, G-22.2ca, G-22.2cb, G-22.2cc, G-22.2cd, G-22.2ce, G-22.2cf, G-22.2cg, G-22.2ch, G-22.2ci, G-22.2cj, G-22.2ck, G-22.2cl, G-22.2cm, G-22.2cn, G-22.2co, G-22.2cp, G-22.2cq, G-22.2cr, G-22.2cs, G-22.2ct, G-22.2cu, G-22.2cv, G-22.2cw, G-22.2cx, G-22.2cy, G-22.2cz, G-22.2da, G-22.2db, G-22.2dc, G-22.2dd, G-22.2de, G-22.2df, G-22.2dg, G-22.2dh, G-22.2di, G-22.2dj, G-22.2dk, G-22.2dl, G-22.2dm, G-22.2dn, G-22.2do, G-22.2dp, G-22.2dq, G-22.2dr, G-22.2ds, G-22.2dt, G-22.2du, G-22.2dv, G-22.2dw, G-22.2dx, G-22.2dy, G-22.2dz, G-22.2ea, G-22.2eb, G-22.2ec, G-22.2ed, G-22.2ee, G-22.2ef, G-22.2eg, G-22.2eh, G-22.2ei, G-22.2ej, G-22.2ek, G-22.2el, G-22.2em, G-22.2en, G-22.2eo, G-22.2ep, G-22.2eq, G-22.2er, G-22.2es, G-22.2et, G-22.2eu, G-22.2ev, G-22.2ew, G-22.2ex, G-22.2ey, G-22.2ez, G-22.2fa, G-22.2fb, G-22.2fc, G-22.2fd, G-22.2fe, G-22.2ff, G-22.2fg, G-22.2fh, G-22.2fi, G-22.2fj, G-22.2fk, G-22.2fl, G-22.2fm, G-22.2fn, G-22.2fo, G-22.2fp, G-22.2fq, G-22.2fr, G-22.2fs, G-22.2ft, G-22.2fu, G-22.2fv, G-22.2fw, G-22.2fx, G-22.2fy, G-22.2fz, G-22.2ga, G-22.2gb, G-22.2gc, G-22.2gd, G-22.2ge, G-22.2gf, G-22.2gg, G-22.2gh, G-22.2gi, G-22.2gj, G-22.2gk, G-22.2gl, G-22.2gm, G-22.2gn, G-22.2go, G-22.2gp, G-22.2gq, G-22.2gr, G-22.2gs, G-22.2gt, G-22.2gu, G-22.2gv, G-22.2gw, G-22.2gx, G-22.2gy, G-22.2gz, G-22.2ha, G-22.2hb, G-22.2hc, G-22.2hd, G-22.2he, G-22.2hf, G-22.2hg, G-22.2hh, G-22.2hi, G-22.2hj, G-22.2hk, G-22.2hl, G-22.2hm, G-22.2hn, G-22.2ho, G-22.2hp, G-22.2hq, G-22.2hr, G-22.2hs, G-22.2ht, G-22.2hu, G-22.2hv, G-22.2hw, G-22.2hx, G-22.2hy, G-22.2hz, G-22.2ia, G-22.2ib, G-22.2ic, G-22.2id, G-22.2ie, G-22.2if, G-22.2ig, G-22.2ih, G-22.2ii, G-22.2ij, G-22.2ik, G-22.2il, G-22.2im, G-22.2in, G-22.2io, G-22.2ip, G-22.2iq, G-22.2ir, G-22.2is, G-22.2it, G-22.2iu, G-22.2iv, G-22.2iw, G-22.2ix, G-22.2iy, G-22.2iz, G-22.2ja, G-22.2jb, G-22.2jc, G-22.2jd, G-22.2je, G-22.2jf, G-22.2jg, G-22.2jh, G-22.2ji, G-22.2jj, G-22.2jk, G-22.2jl, G-22.2jm, G-22.2jn, G-22.2jo, G-22.2jp, G-22.2jq, G-22.2jr, G-22.2js, G-22.2jt, G-22.2ju, G-22.2jv, G-22.2jw, G-22.2jx, G-22.2jy, G-22.2jz, G-22.2ka, G-22.2kb, G-22.2kc, G-22.2kd, G-22.2ke, G-22.2kf, G-22.2kg, G-22.2kh, G-22.2ki, G-22.2kj, G-22.2kk, G-22.2kl, G-22.2km, G-22.2kn, G-22.2ko, G-22.2kp, G-22.2kq, G-22.2kr, G-22.2ks, G-22.2kt, G-22.2ku, G-22.2kv, G-22.2kw, G-22.2kx, G-22.2ky, G-22.2kz, G-22.2la, G-22.2lb, G-22.2lc, G-22.2ld, G-22.2le, G-22.2lf, G-22.2lg, G-22.2lh, G-22.2li, G-22.2lj, G-22.2lk, G-22.2ll, G-22.2lm, G-22.2ln, G-22.2lo, G-22.2lp, G-22.2lq, G-22.2lr, G-22.2ls, G-22.2lt, G-22.2lu, G-22.2lv, G-22.2lw, G-22.2lx, G-22.2ly, G-22.2lz, G-22.2ma, G-22.2mb, G-22.2mc, G-22.2md, G-22.2me, G-22.2mf, G-22.2mg, G-22.2mh, G-22.2mi, G-22.2mj, G-22.2mk, G-22.2ml, G-22.2mm, G-22.2mn, G-22.2mo, G-22.2mp, G-22.2mq, G-22.2mr, G-22.2ms, G-22.2mt, G-22.2mu, G-22.2mv, G-22.2mw, G-22.2mx, G-22.2my, G-22.2mz, G-22.2na, G-22.2nb, G-22.2nc, G-22.2nd, G-22.2ne, G-22.2nf, G-22.2ng, G-22.2nh, G-22.2ni, G-22.2nj, G-22.2nk, G-22.2nl, G-22.2nm, G-22.2nn, G-22.2no, G-22.2np, G-22.2nq, G-22.2nr, G-22.2ns, G-22.2nt, G-22.2nu, G-22.2nv, G-22.2nw, G-22.2nx, G-22.2ny, G-22.2nz, G-22.2oa, G-22.2ob, G-22.2oc, G-22.2od, G-22.2oe, G-22.2of, G-22.2og, G-22.2oh, G-22.2oi, G-22.2oj, G-22.2ok, G-22.2ol, G-22.2om, G-22.2on, G-22.2oo, G-22.2op, G-22.2oq, G-22.2or, G-22.2os, G-22.2ot, G-22.2ou, G-22.2ov, G-22.2ow, G-22.2ox, G-22.2oy, G-22.2oz, G-22.2pa, G-22.2pb, G-22.2pc, G-22.2pd, G-22.2pe, G-22.2pf, G-22.2pg, G-22.2ph, G-22.2pi, G-22.2pj, G-22.2pk, G-22.2pl, G-22.2pm, G-22.2pn, G-22.2po, G-22.2pp, G-22.2pq, G-22.2pr, G-22.2ps, G-22.2pt, G-22.2pu, G-22.2pv, G-22.2pw, G-22.2px, G-22.2py, G-22.2pz, G-22.2qa, G-22.2qb, G-22.2qc, G-22.2qd, G-22.2qe, G-22.2qf, G-22.2qg, G-22.2qh, G-22.2qi, G-22.2qj, G-22.2qk, G-22.2ql, G-22.2qm, G-22.2qn, G-22.2qo, G-22.2qp, G-22.2qq, G-22.2qr, G-22.2qs, G-22.2qt, G-22.2qu, G-22.2qv, G-22.2qw, G-22.2qx, G-22.2qy, G-22.2qz, G-22.2ra, G-22.2rb, G-22.2rc, G-22.2rd, G-22.2re, G-22.2rf, G-22.2rg, G-22.2rh, G-22.2ri, G-22.2rj, G-22.2rk, G-22.2rl, G-22.2rm, G-22.2rn, G-22.2ro, G-22.2rp, G-22.2rq, G-22.2rr, G-22.2rs, G-22.2rt, G-22.2ru, G-22.2rv, G-22.2rw, G-22.2rx, G-22.2ry, G-22.2rz, G-22.2sa, G-22.2sb, G-22.2sc, G-22.2sd, G-22.2se, G-22.2sf, G-22.2sg, G-22.2sh, G-22.2si, G-22.2sj, G-22.2sk, G-22.2sl, G-22.2sm, G-22.2sn, G-22.2so, G-22.2sp, G-22.2sq, G-22.2sr, G-22.2ss, G-22.2st, G-22.2su, G-22.2sv, G-22.2sw, G-22.2sx, G-22.2sy, G-22.2sz, G-22.2ta, G-22.2tb, G-22.2tc, G-22.2td, G-22.2te, G-22.2tf, G-22.2tg, G-22.2th, G-22.2ti, G-22.2tj, G-22.2tk, G-22.2tl, G-22.2tm, G-22.2tn, G-22.2to, G-22.2tp, G-22.2tq, G-22.2tr, G-22.2ts, G-22.2tt, G-22.2tu, G-22.2tv, G-22.2tw, G-22.2tx, G-22.2ty, G-22.2tz, G-22.2ua, G-22.2ub, G-22.2uc, G-22.2ud, G-22.2ue, G-22.2uf, G-22.2ug, G-22.2uh, G-22.2ui, G-22.2uj, G-22.2uk, G-22.2ul, G-22.2um, G-22.2un, G-22.2uo, G-22.2up, G-22.2uq, G-22.2ur, G-22.2us, G-22.2ut, G-22.2uu, G-22.2uv, G-22.2uw, G-22.2ux, G-22.2uy, G-22.2uz, G-22.2va, G-22.2vb, G-22.2vc, G-22.2vd, G-22.2ve, G-22.2vf, G-22.2vg, G-22.2vh, G-22.2vi, G-22.2vj, G-22.2vk, G-22.2vl, G-22.2vm, G-22.2vn, G-22.2vo, G-22.2vp, G-22.2vq, G-22.2vr, G-22.2vs, G-22.2vt, G-22.2vu, G-22.2vv, G-22.2vw, G-22.2vx, G-22.2vy, G-22.2vz, G-22.2wa, G-22.2wb, G-22.2wc, G-22.2wd, G-22.2we, G-22.2wf, G-22.2wg, G-22.2wh, G-22.2wi, G-22.2wj, G-22.2wk, G-22.2wl, G-22.2wm, G-22.2wn, G-22.2wo, G-22.2wp, G-22.2wq, G-22.2wr, G-22.2ws, G-22.2wt, G-22.2wu, G-22.2wv, G-22.2ww, G-22.2wx, G-22.2wy, G-22.2wz, G-22.2xa, G-22.2xb, G-22.2xc, G-22.2xd, G-22.2xe, G-22.2xf, G-22.2xg, G-22.2xh, G-22.2xi, G-22.2xj, G-22.2xk, G-22.2xl, G-22.2xm, G-22.2xn, G-22.2xo, G-22.2xp, G-22.2xq, G-22.2xr, G-22.2xs, G-22.2xt, G-22.2xu, G-22.2xv, G-22.2xw, G-22.2xx, G-22.2xy, G-22.2xz, G-22.2ya, G-22.2yb, G-22.2yc, G-22.2yd, G-22.2ye, G-22.2yf, G-22.2yg, G-22.2yh, G-22.2yi, G-22.2yj, G-22.2yk, G-22.2yl, G-22.2ym, G-22.2yn, G-22.2yo, G-22.2yp, G-22.2yq, G-22.2yr, G-22.2ys, G-22.2yt, G-22.2yu, G-22.2yv, G-22.2yw, G-22.2yx, G-22.2yy, G-22.2yz, G-22.2za, G-22.2zb, G-22.2zc, G-22.2zd, G-22.2ze, G-22.2zf, G-22.2zg, G-22.2zh, G-22.2zi, G-22.2zj, G-22.2zk, G-22.2zl, G-22.2zm, G-22.2zn, G-22.2zo, G-22.2zp, G-22.2zq, G-22.2zr, G-22.2zs, G-22.2zt, G-22.2zu, G-22.2zv, G-22.2zw, G-22.2zx, G-22.2zy, G-22.2zz

11/69/63

## INSTRUCTIONS

1. This application shall be used to apply for an alien registration card in lieu of one lost, mutilated or destroyed, or in a changed name. (Note: Upon request, evidence of registration surrendered by a lawful permanent resident alien on other than Form I-151, such as AR-3 or AR-103, will be replaced with Form I-151 without fee or application.)
2. Submit this application in single copy only.
3. **DOCUMENTARY EVIDENCE** - An applicant for a new alien registration receipt card in a changed name, whose name has been changed after registration by order of court or by marriage, shall attach appropriate documentary evidence of such change to this application.
4. **PHOTOGRAPHS** - You are required to send with this application 2 identical photographs of yourself taken within 30 days of the date of this application. These photographs must be 1 1/4 X 1 1/4 inches in size, and the distance from top of head to point of chin should be approximately 1 1/4 inches. They must NOT be pasted on the cards or mounted in any other way, must be on thin paper, have a light background, and clearly show a front view of your face without hat. Snapshots, group or full-length portraits will not be accepted. **DO NOT SIGN YOUR PHOTOGRAPHS.** Using crayon or soft pencil to avoid possible mutilation of the photographs, write your alien registration number lightly on the reverse of the photographs.
5. **DATE OF YOUR ARRIVAL** - If you do not know the exact date of your arrival in the United States, or the name of the vessel or port, and you cannot obtain this information by consulting your family or friends who came over with you, give the facts of your arrival as you remember them in the appropriate blank spaces on the first page of this form. Your Immigrant Identification Card or your passport, ship's card, or baggage labels, if you have them, may help you to answer these questions.
6. **FEE** - A fee of five dollars (\$5) must accompany this application. Remittances should be made payable to the "Immigration and Naturalization Service, Department of Justice." If residing in the Virgin Islands, remittances should be drawn in favor of the "Commissioner of Finance of the Virgin Islands." If residing in Guam, remittances should be drawn in favor of the "Treasurer, Guam." If you mail this application, attach money order or check. **DO NOT SEND CASH.** The fee is required for filing application and is not returnable regardless of action taken thereon.

TO APPLICANT. - Do not write below this line.

RECORDS EXAMINED	RECORDS FOUND
Card index _____	Place <u>NYC</u>
Index books _____	Name <u>MARINA N. OSWALD</u>
Manifests _____	Date <u>6-13-62</u>
_____	Manner <u>M-1</u>
_____	Marital status <u>M-</u>
_____	<u>Eglin</u> (Signature of person making search)
REMARKS OF CONSULAR OFFICER	
<div style="display: flex; justify-content: space-between; align-items: flex-end;"> <div>           (Date) <u>June 13, 1962</u>            I recommend that the application be  <input checked="" type="checkbox"/> Granted    <input type="checkbox"/> Denied  <u>E. J. [Signature]</u>            Immigration Officer         </div> <div>           Recommendation  <input type="checkbox"/> Approved    <input type="checkbox"/> Disapproved  <u>[Signature]</u>            District Director         </div> </div>	

GPO 350700



КЛЮЧЕВЫЕ СЛОВА НА ПОЛУЧЕНИЕ ИММИГРАЦИОННОЙ ВИЗЫ И РЕГИСТРАЦИИ ИНОСТРАНЦА  
KEYWORDS FOR IMMIGRANT VISA AND ALIEN REGISTRATION

1. The form must be filled out in DUPLICATE by typewriter, or if by hand in legible block letters. All questions must be answered if applicable. Questions which are not applicable should be so marked. If there is insufficient room on the form, answer on separate sheets in duplicate using the same numbers as appear on the form. Attach the sheets to the form. The fee for filing this application for a passport is \$5.00. The fee should be paid in United States dollars or \$5.00 by the consular office. You appear before the consular officer.

Ваше заявление или раскрытие существенного факта может иметь последствиям Ваше постановление. Даже если Вы и являетесь в Соединенные Штаты, ложные данные могут быть использованы на Вас в Соединенных Штатах.

As the presence of a material fact may result in your permanent exclusion from the United States. Even if the fact is not true, a fraudulent entry could be ground for your prosecution and/or deportation.)

(I hereby apply for an immigrant visa and alien registration at the United States ..... Embassy at Moscow, USSR and state the following facts:)

Моя фамилия: (My family name is)	Мое имя: (My first name is)	Мое отчество: (My middle name is)
OSWALD.	Marina	Nikolaevna

My full name in native alphabet (if other than Roman letters are used) is: Михаил Николаевич Овсашин

Имя (полное) и фамилия (девичья) или под которыми я была известна (если женщина замужем, она должна указать свою девичью фамилию) (Other names I have used or by which I have been known are (If married woman, give maiden name))  
 Marina Nikolaevna OSWALD nee PRUSAKOVA

6. Дата моего рождения (The date of my birth is)			5. Место моего рождения. (My place of birth is)		
Родился (Day)	Месяц (Month)	Год (Year)	Город или деревня (City or town)	Область (Province)	Страна (Country)
2	7	1943	Саранск Saransk	Архангельская обл Arkhangel'skaya obl	СССР USSR

7. Моя профессия или занятие в настоящее время (My present calling or occupation is) Pharmacist

8. Моё настоящее адрес. Only present address is)  
 Минск. Ст. Коммунистическая 4. Ап. 24

10. Мое семейное положение: (My marital status is) ☒ Холост (В браке никогда не состоял) (a) (Single (Never married)) ☒ Женат/Замужем (Married) ☐ Вдовец/Вдова (Widowed) ☐ Разведен(а) (Divorced) ☐ Не живу с мужем/женой (Separate)

Выполнен мой настоящий брак, я состою(а) в браке (including my present marriage, I have been married		1	раз. times)
11. Моя национальность: (My nationality is	12. Моя раса: (My race is)	13. Моя этническая классификация: (My ethnic classification)	

Soviet			
14. How would you describe your personal description is)			15. Я имею следующие видимые особые приметы. (I have the following visible marks of identification)

(a) <u>LIBRY SOURCE:</u> (Name of bank)	(b) <u>PAGE (Height)</u> 1 62 u (in) cm (inch)	(c) <u>LIBRY AGE:</u> (Name of bank)
(d) <u>LIBRY AGE:</u> (Name of bank)	(e) <u>LIBRY AGE:</u> (Complexion)	no

grey-blue	white
18. (U.S. and Mexican) Consignee Name: (My purpose in going to the United States is)	

For permanent residence with husband Lee Harvey Oswald

<p> <input type="checkbox"/> Intend to remain in the United States permanently or (Give length of time)  <u>Permanently</u> </p>	<p> <input type="checkbox"/> Intend to enter the United States at the port of         </p>
--	--

20. (6) Моим поручителем является следующее лицо и/или организация (укажите адрес, если применимо от (4))  
(My sponsor is the following person and/or organization (Give address if applicable to (4))

Mr. Lee Harvey Oswald,  
2001 N. Pecos  
Dallas, Texas 75201

21. Мой постоянный адрес в Соединенных Штатах (Судов: (My final address in the United States is)

See Item #20(a)

Этот бланк может быть получен бесплатно в консульских представительствах Соединенных Штатов Америки

Этот бланк может быть получен бесплатно в консульских представительствах Соединенных Штатов Америки  
(This form may be obtained gratis at consular offices of the United States of America)

~~WAC~~ 10/29/62



22. Мои личные финансовые ресурсы следующие: (My personal financial resources are)

(a) Наличные (Cash)

X

(b) Недвижимое имущество (отражено) (Real estate (value))

X

(c) В банке (Bank deposits)

X

(d) Иное поле (Other)

X

23. Представляю следующие личные документы в поддержку моего заявления. (I am submitting the following personal documents in support of and as part of my application)

☒ Сертификат о рождении (Birth certificate)☐ Справка о военном учете (Military record)☐ Отделение работы (Premise of employment)☐ Справка из милиции (Police certificate)☒ Документальное свидетельство или о личных ресурсах (Evidence of support or own resources)☒ Медицинская справка (Medical record)☐ Прочие документы (дать описание) (Other (describe))

Petition ; Marriage cert.

24. Полное имя и настоящий адрес моей(го) супруги(а) (Ваше(го) личное фамилия(и) Вашей супруги)  
(Name and present residence of my wife/husband is (Give maiden name of wife))

Mr. LeeHarvey OSWALD, Minsk, St. Kommunisticheskaya 4, Apt.24

25. Имена и адреса моих детей младше 21 года: (The names and addresses of my children under 21 years of age are)

June Lee Oswald, Minsk, St. Kommunisticheskaya 4, Apt.24

26. Имена членов моей семьи, которые иммигрируют вместе со мной: (The names of members of my family who are immigrating with me are)

husband and daughter accompanying me to the United States - both of US citizens.

27. Полное имя и адрес моего отца (если он умер, укажите дату смерти) (The name and address of my father is (If deceased, so state, giving date))

28. Личное имя и адрес моей матери (если она умерла, укажите дату смерти)  
(The maiden name and address of my mother is (If deceased, so state, giving date))

Klavdiya Vasilevna Prusakova -deceased

29. Полное имя и адрес моих близких родственников из моей родины (The name and address of my next of kin in my home country is)

Uncle Ilya V. Prusakov, Minsk, St. Kommunisticheskaya 39/42, Apt.20

30. Со времени моего шестнадцатилетия, я жил в следующих местах в течение шести месяцев или больше:  
(Since my sixteenth birthday my places of residence for 6 months or more have been)Город  
(City or town)  
Leningrad  
MinskОбласть  
(Province)Страна  
(Country)USSR  
USSRДаты (от и до)  
(Dates (from-to))  
1957-1959  
1959-to presentЗанятие или профессия  
(Calling or occupation)  
student  
pharmacist31. Со времени моего шестнадцатилетия я состою или состою членом или был сотрудником следующих политических, профессиональных, неофициальных или общественных организаций: (Since my sixteenth birthday I am or have been a member or affiliate of the following political, professional, vocational or social organizations)  
Название организации и адрес  
(Name and address)  
None  
Даты (от и до)  
(Dates (from-to))  
None  
Какая членом был и занимал ли какую-нибудь должность в организации  
(Type of membership and office held, if any)

32. Я говорю, читаю и пишу на следующих языках (включая Ваш родной язык): (I speak, read, write the following language (include your native language))

Язык язык  
(Language)  
RussianГоворю  
(Speak)  
YesЧитаю  
(Read)  
YesПишу  
(Write)  
Yes

33. Я был(а) ранее в Соединенных Штатах в течение следующих периодов (укажите год, истечение визы или статус) (Have we been in the United States during the following periods (Give year and type of visa or status (If never, so state))

None

(United States Immigration laws require all prospective immigrants answer the following questions. This requirement does not imply that you are suspected of being within any of the classes, described in these questions. Your answers will assist the consular officer to establish your eligibility to receive a visa. If you are unable to answer any of these questions please explain your inability fully on a separate sheet of paper which you should attach to this form. Please bear in mind that whatever the nature of your answers to these questions, you are not necessarily ineligible to receive a visa. For example, if you were arrested and found guilty of a minor offense and the consular officer is able to establish that such offense was in fact a misdemeanor, your arrest and/or conviction would not necessarily be a bar to receiving a visa.) (Give the correct answer to the following questions by circling "Yes" or "No".)

(1) Были ли Вы когда-либо обвинены в проступках, равносильных в суду по осуждению за преступление или за какой-либо проступок? (Have you ever been arrested for, charged with, indicted for, or convicted of a crime or other offense?)	Да	Yes	Нет	No
(2) Были ли Вы когда-либо заключены в гражданскую тюрьму? (Have you ever been confined in a civilian prison or jail?)	Да	Yes	Нет	No
(3) Были ли Вы когда-либо заключены в военную тюрьму? (Have you ever been confined in a military prison or jail?)	Да	Yes	Нет	No
(4) Занимались ли Вы когда-либо незаконной покупкой или продажей наркотиков или имели какое-либо отношение к наркотикам? (Have you ever been engaged in illicit buying, selling or handling of narcotic drugs?)	Да	Yes	Нет	No
(5) Были ли Вы когда-либо амнистированы, реабилитированы, или имели другого рода смягчения наказания? (Если да, объясните. Have you ever been amnestied, the beneficiary of a pardon, amnesty, rehabilitation decree, other act of clemency or similar action? (If so, explain.)	Да	Yes	Нет	No
(6) Были ли Вы когда-либо помощником в дом для престарелых или иного благотворительного заведения? (Have you ever been employed in old people's or charitable institution?)	Да	Yes	Нет	No
(7) Хотите ли Вы быть финансово поддержаны за Ваши профессиональные навыки или таланты? (Are you a pauper, professional beggar or vagrant?)	Да	Yes	Нет	No
(8) Считаете ли Вы в настоящее время каким-либо физическим недостатком или несоблюдением или болезнью, которые могут повлиять на Вашу способность зарабатывать на жизнь? (Are you now afflicted with a physical defect, disease or disability which may affect your ability to earn a living?)	Да	Yes	Нет	No
(9) Хотите ли Вы в настоящее время финансово поддерживать себя в Соединенных Штатах? (Will you be able to support yourself financially in the United States?)	Да	Yes	Нет	No
(10) Были ли Вы когда-либо обвинены или признаны умственно неполноценным? (Have you ever had one or more attacks of insanity?)	Да	Yes	Нет	No
(11) Присутствует ли в Вас в настоящее время или страдал раньше психический, интеллектуальный, душевный недостаток, приходящий к психическим приступам, конвульсиям или нервным расстройствам? (Are you now or have you ever been afflicted with psychopathic personality, epilepsy, mental defect, fits, fainting spells, convulsions or a nervous breakdown?)	Да	Yes	Нет	No
(12) Обращались ли Вы теперь или были ли Вы раньше параноиком или хроническим алкоголиком? (Are you now or have you ever been afflicted with paranoia or chronic alcoholism?)	Да	Yes	Нет	No
(13) Были ли Вы когда-либо на лечении в больнице, психоневрологическом или другом учреждении от умственной неполноценности или душевного, психического расстройства или от наркомании или алкоголизма? (Have you ever been treated in a hospital, institution or elsewhere for insanity or other mental disorder or for drug or narcotic addiction or alcoholism?)	Да	Yes	Нет	No
(14) Были ли Вы когда-либо одной из следующих болезней: (Have you ever had any of the following:)				
(A) Туберкулезом в любой форме? (Tuberculosis in any form?)	Да	Yes	Нет	No
(B) Прокроз? (Leprosy?)	Да	Yes	Нет	No
(C) Какой-либо иной опасной заразной болезнью? (Any other dangerous contagious disease?)	Да	Yes	Нет	No
(15) Насколько ли Вы, практикуете ли Вы многоженство или пропагандируете ли Вы осуществление многоженства? (Are you a polygamist, do you practice polygamy, or do you advocate the practice of polygamy?)	Да	Yes	Нет	No
(16) Являлись ли Вы теперь или были ли Вы когда-либо проституткой, содейвавшей или жила целиком или частично на доходы, получаемые от проституции? (Are you or have you ever been a prostitute, procurer, or supported wholly or in part from the proceeds of prostitution?)	Да	Yes	Нет	No
(17) Были ли Вы в Соединенных Штатах для того, чтобы заниматься безнравственными половыми актами, проституцией или другими нечестными и неэтичными делами, являющимися для закона преступлением? (Are you going to the United States to engage in an immoral activity, sex act, prostitution, or other unethical/unlawful sexualized vice?)	Да	Yes	Нет	No
(18) Обращались ли Вы, лично с прошением о выдаче Вам визы в США в Соединенные Штаты в качестве иммигранта? (Если ответ "Да", то как часто, куда и где Вы обращались за иммиграционной или иммиграционной визой в США в том месте, куда Вы ранее применялись для визы в США? (If answer is "Yes", state where and when, whether you applied for an immigrant or as a nonimmigrant? (If answer is "Yes", submit evidence that the Attorney General has consented to your replying for admission into the United States.)	Да	Yes	Нет	No
(19) Были ли Вы когда-либо в течение 12 месяцев до подачи заявления о приеме в США в течение последних двенадцати месяцев? (Если ответ "Да", то как часто, куда и где Вы обращались за иммиграционной или иммиграционной визой в США в том месте, куда Вы ранее применялись для визы в США? (If answer is "Yes", submit evidence that the Attorney General has consented to your replying for admission into the United States.)	Да	Yes	Нет	No
(20) Были ли Вы когда-либо обвинены или признаны умственно неполноценным? (Have you ever had one or more attacks of insanity?)	Да	Yes	Нет	No
(21) Были ли Вы когда-либо обвинены или признаны умственно неполноценным? (Have you ever had one or more attacks of insanity?)	Да	Yes	Нет	No
(22) Были ли Вы когда-либо обвинены или признаны умственно неполноценным? (Have you ever had one or more attacks of insanity?)	Да	Yes	Нет	No
(23) Были ли Вы когда-либо обвинены или признаны умственно неполноценным? (Have you ever had one or more attacks of insanity?)	Да	Yes	Нет	No
(24) Были ли Вы когда-либо обвинены или признаны умственно неполноценным? (Have you ever had one or more attacks of insanity?)	Да	Yes	Нет	No
(25) Были ли Вы когда-либо обвинены или признаны умственно неполноценным? (Have you ever had one or more attacks of insanity?)	Да	Yes	Нет	No
(26) Были ли Вы когда-либо обвинены или признаны умственно неполноценным? (Have you ever had one or more attacks of insanity?)	Да	Yes	Нет	No
(27) Были ли Вы когда-либо обвинены или признаны умственно неполноценным? (Have you ever had one or more attacks of insanity?)	Да	Yes	Нет	No
(28) Были ли Вы когда-либо обвинены или признаны умственно неполноценным? (Have you ever had one or more attacks of insanity?)	Да	Yes	Нет	No
(29) Были ли Вы когда-либо обвинены или признаны умственно неполноценным? (Have you ever had one or more attacks of insanity?)	Да	Yes	Нет	No
(30) Были ли Вы когда-либо обвинены или признаны умственно неполноценным? (Have you ever had one or more attacks of insanity?)	Да	Yes	Нет	No
(31) Были ли Вы когда-либо обвинены или признаны умственно неполноценным? (Have you ever had one or more attacks of insanity?)	Да	Yes	Нет	No
(32) Были ли Вы когда-либо обвинены или признаны умственно неполноценным? (Have you ever had one or more attacks of insanity?)	Да	Yes	Нет	No
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(35) Были ли Вы когда-либо обвинены или признаны умственно неполноценным? (Have you ever had one or more attacks of insanity?)	Да	Yes	Нет	No
(36) Были ли Вы когда-либо обвинены или признаны умственно неполноценным? (Have you ever had one or more attacks of insanity?)	Да	Yes	Нет	No
(37) Были ли Вы когда-либо обвинены или признаны умственно неполноценным? (Have you ever had one or more attacks of insanity?)	Да	Yes	Нет	No
(38) Были ли Вы когда-либо обвинены или признаны умственно неполноценным? (Have you ever had one or more attacks of insanity?)	Да	Yes	Нет	No
(39) Были ли Вы когда-либо обвинены или признаны умственно неполноценным? (Have you ever had one or more attacks of insanity?)	Да	Yes	Нет	No
(40) Были ли Вы когда-либо обвинены или признаны умственно неполноценным? (Have you ever had one or more attacks of insanity?)	Да	Yes	Нет	No
(41) Были ли Вы когда-либо обвинены или признаны умственно неполноценным? (Have you ever had one or more attacks of insanity?)	Да	Yes	Нет	No
(42) Были ли Вы когда-либо обвинены или признаны умственно неполноценным? (Have you ever had one or more attacks of insanity?)	Да	Yes	Нет	No
(43) Были ли Вы когда-либо обвинены или признаны умственно неполноценным? (Have you ever had one or more attacks of insanity?)	Да	Yes	Нет	No
(44) Были ли Вы когда-либо обвинены или признаны умственно неполноценным? (Have you ever had one or more attacks of insanity?)	Да	Yes	Нет	No
(45) Были ли Вы когда-либо обвинены или признаны умственно неполноценным? (Have you ever had one or more attacks of insanity?)	Да	Yes	Нет	No
(46) Были ли Вы когда-либо обвинены или признаны умственно неполноценным? (Have you ever had one or more attacks of insanity?)	Да	Yes	Нет	No
(47) Были ли Вы когда-либо обвинены или признаны умственно неполноценным? (Have you ever had one or more attacks of insanity				

(8) Можете ли Вы, если Вы старше шестидесяти лет, читать и понимать какой-нибудь язык или диалект? (Can you, if you are over sixty years, read and understand some language or dialect?)	Да	Нет
(9) Содействовали ли Вы когда-нибудь, либо намерены, другим иностранцам въехать в Соединенные Штаты в нарушение закона Соединенных Штатов? (Have you for any reason assisted another alien to enter the United States or try to enter the United States in violation of the laws of the United States?)	Да	Нет
(10) Являлись ли Вы бывшим участником обменной программ, который не прожил за границей в течение двух лет после отъезда из Соединенных Штатов? (Are you a former exchange visitor who has not resided abroad for two years following your departure from the United States?)	Да	Нет
(11) Являетесь ли Вы теперь или были ли Вы когда-либо. (Are you now or have you ever been)		
(a) коммунистом? (an communist?)	Да	Нет
(b) сторонником оппозиции всем организмованным правительствам? (an advocate of opposition to all organized government?)	Да	Нет
(c) сторонником коммунизма? (an advocate of Communism?)	Да	Нет
(f) членом или сторонником коммунистической партии или филиальных отделений ее или организации, пропагандирующей коммунизм, или организации под контролем или влиянием коммунистической или организации, пропагандирующей или содействующей свержению законного организмованного правительства, или какой-либо другой подобной организации? (a member of or affiliated with, the Communist Party or affiliated organization, an organization advocating Communism or a Communist-dominated or controlled organization or an organization advocating the overthrow by force of all organized government or any other similar organization?)	Да	Нет
(Если Вы ответ на какой-либо из вышеуказанных вопросов — «Да», то представьте объяснение, указывая дату и род деятельности или членства.) (If the answer to any of the above questions is Yes, explain, giving dates and nature of activities or membership.)		
(12) Намерены ли Вы въехать в Соединенные Штаты из Канады, Мексики, или с острова, прилегающего к Соединенным Штатам, в течение двух лет после Вашего прибытия в такую страну или на такой острове? (Если Вы ответ — «Да», то укажите название перевозочной компании, через которую Вы въехали или собираетесь въехать в такую страну или на такой острове.) (Do you intend to enter the United States from Canada, Mexico or an island adjacent to the United States within two years after arrival in such country or island? (If answer is Yes, give the name of transportation company by which you entered or intend to enter such country or island))	Да	Нет
38. Помогал ли Вам кто-либо в заполнении этой анкеты? (Если «Да», то укажите имя и адрес этого лица (или имена и адреса), которые Вам помогли, указывая также, кем было это лицо: родственник, друг, адвокат, агент бюро путешествий, и т.д.) (Were you assisted in completing this application? (If so, give name and address of person or persons assisting you indicating whether relative, friend, attorney, travel agent, or other).)		
ИМЯ	АДРЕС	
Name	Address	
ПО		

**НЕ ПИШИТЕ НИЖЕ ЭТОЙ ЛИНИИ**  
(DO NOT WRITE BELOW THE FOLLOWING LINE)

Консульский сотрудник поможет Вам ответить на последующие вопросы № 36 и 37  
(The consular officer will assist you in answering the following parts 36 and 37)

36. Я утверждаю, что я не должен считаться лицом, непригодным для получения визы и что я не подпадаю исключительно по параграфу прося № 34 по следующим причинам: (I claim to be exempt from ineligibility to receive a visa and exclusion under Item in part 24 for the following reasons.)	37. Я утверждаю, что я (I claim to be a)
<input type="checkbox"/> Подлежу к	категории вынужденных иммигрантов по квоте
<input type="checkbox"/> Подлежу к вынужденным иммигрантам. (Nonquota immigrant.)	квоте

Мое утверждение основано на следующих фактах: (My claim is based on the following facts):

**Wife of American citizen. Petition approved Feb. 28, 1962.**

Я понимаю, что я должен сдать свою анкету сотрудникам Иммиграционной Службы Соединенных Штатов в том месте, где я прошу разрешения с визой въехать в Соединенные Штаты, и что обладание визой не дает мне права въехать в Соединенные Штаты, если в это время я буду найден неподходящим для въезда по иммиграционным законам.  
(I understand that I am required to surrender my visa to the United States Immigration Officer at the place where I apply to enter the United States, and that the possession of a visa does not entitle me to enter the United States if at that time I am found to be inadmissible under the immigration laws.)

Я понимаю, что всякое преднамеренное ложное или вводящее в заблуждение заявление, или преднамеренное скрптие существенного факта, сделанное мною в данной анкете, может повлечь за собой постоянное недопущение меня в Соединенные Штаты и, если я буду допущен в Соединенные Штаты, может подвергнуть меня уголовному преследованию и/или депортации.  
(I understand that any willfully false or misleading statement or willful concealment of a material fact made by me herein may subject me to permanent exclusion from the United States and, if I am admitted to the United States, may subject me to criminal prosecution and/or deportation.)

Я, нижеподписавшийся проситель иммиграционной визы Соединенных Штатов, торжественно клянусь (или утверждаю), что все заявления в данной анкете были сделаны мною, включая ответные на вопросы раздела № 34, и я знаю и уверен, что они полны и правдивы. Я даю клятву (или утверждаю), что, если мне будет разрешен въезд в Соединенные Штаты, я не буду делать ничего, что могло бы нанести ущерб общественным интересам или угрожать безопасности, охраняемой законами Соединенных Штатов; не буду делать ничего, что запрещено законами Соединенных Штатов, относящимися к шпионажу, саботажу, нарушению общественного порядка или других актов, угрожающих государственной безопасности; не буду заниматься деятельностью, цель которой быть и оппонировать Правительству Соединенных Штатов или захвата контроля, или свержения Правительства Соединенных Штатов силой, насилием или другими средствами, не предусмотренными Конституцией; не буду присоединяться, поддерживать или участвовать в деятельности любой организации, которая зарегистрирована или подлежит регистрации согласно разделу 7 Закона 1960 года о Борьбе с Подверженными Действиями. Я понимаю все вышеизложенные заявления так как я прошу и получил объяснение по каждому пункту, который был мне не ясен.  
(I, the undersigned applicant for a United States immigrant visa, solemnly swear (or affirm) that all statements which appear in this application have been made by me, including the surrendering of Items in part 24, and are true and complete to the best of my knowledge and belief. I do further swear (or affirm) that if admitted into the United States, I will not engage in activities which would be prejudicial to the public interest, or endanger the welfare, safety, or security of the United States, in activities which would be prohibited by the laws of the United States relating to espionage, public disorder or in other activities subversive to the national security, in any activity a purpose of which is the opposition to, or the control, or overthrow of, the Government of the United States, by force, violence, or other unconstitutional means, or join, affiliate with, or participate in the activities of any organization which is registered or required to be registered under Section 7 of the Subversive Activities Control Act of 1950. I understand all the foregoing statements, having asked for and obtained an explanation on every point which was not clear to me.)

*H. Oswald*  
**Marina H. OSWALD**

Проситель иммиграционной визы

*Jack P. Matlock*

**Jack P. Matlock**

**American Consul**

Консул Соединенных Штатов Америки

(Consular Officer)

Подписано в консульстве и представлено в моем присутствии сего  
(Signed and sworn to before me this 21st day of May 1962)

Service No. 152090 Fee paid U.S. \$3.00  
Permit Item No. 20 Local Cy Requir. 4.50 rubbles



Form AR-1  
(Rev. 6-1-56) United States  
No. 48-1007-5

**AN REGISTRATION FINGERPRINT CHART**  
UNITED STATES DEPARTMENT OF JUSTICE  
IMMIGRATION AND NATURALIZATION SERVICE

OFFICIAL STAMP

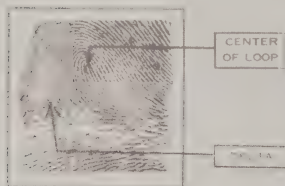
**INSTRUCTIONS**

**To obtain classifiable fingerprints:**

1. Use printer's ink.
2. Distribute ink evenly on inking slab.
3. Wash and dry fingers thoroughly.
4. Roll fingers from nail to nail, and avoid allowing fingers to slip.
5. Be sure impressions are recorded in correct order.
6. If an amputation or deformity makes it impossible to print a finger, make a notation to that effect in the individual finger block.
7. If some physical condition makes it impossible to obtain perfect impressions, submit the best that can be obtained with a memo stapled to the card explaining the circumstances.
8. Examine the completed prints to see if they can be classified, bearing in mind the following:

Most fingerprints fall into the patterns shown below (other patterns occur infrequently and are not shown here):

**1. LOOP**



THE LINES BETWEEN CENTER OF LOOP AND DELTA MUST SHOW

**2. WHORL**



THESE LINES RUNNING BETWEEN DELTAS MUST BE CLEAR

**3. ARCH**



ARCHES HAVE NO DELTAS

- (a) A delta (Δ) is the point at which the lines forming the loop or whorl pattern spread and begin going in different directions. All loop prints have one delta. Whorl prints have two.
  - (b) Loop prints cannot be classified unless the center of the loop and the delta, and the lines between them, are clear.
  - (c) Whorl prints cannot be classified unless the two deltas and the lines connecting the deltas are clear.
  - (d) Arch fingerprints can be classified if a sufficiently clear impression is obtained to permit identification of the pattern as being an arch.
9. If, upon examination, it appears that any of the impressions cannot be classified, new prints should be made. If not more than three impressions are unclassifiable, new prints of these fingers may be taken and pasted over the defective ones. If more than three are unclassifiable, make a new chart.

☆ U. S. GOVERNMENT PRINTING OFFICE: 1956-O-387433

THIS SPACE FOR FBI USE

JUN 18 1962 6



ALIEN SIGNATURE OF PERSON FINGERPRINTED <i>N. Oswald</i> Marina N. OSWALD UNITED STATES ADDRESS OF PERSON FINGERPRINTED STREET 7313 Davanport CITY Fort Worth STATE Texas SIGNATURE AND TITLE OF OFFICIAL TAKING FINGERPRINTS <i>Belone</i> DATE MAY 24 1962		LEAVE THIS SPACE BLANK (Last name) OSWALD, ALIASES DEPARTMENT OF JUSTICE ALIEN NUMBER A12-530645 HAIR fair EYES blue SCARS AND MARKS no		5'3" 6" Classified (First name) Marina (Middle name) Nikolaevna SEX F DATE OF BIRTH July 17, 1941 NATIONALITY Soviet PLACE OF BIRTH Arkhangelsk obl. LEAVE THIS SPACE BLANK CLASS REF.	
1. RIGHT THUMB		2. RIGHT INDEX		3. RIGHT MIDDLE	
4. RIGHT RING		5. RIGHT LITTLE			
6. LEFT THUMB		7. LEFT INDEX		8. LEFT MIDDLE	
9. LEFT RING		10. LEFT LITTLE			
LEFT FOUR FINGERS		LEFT THUMB		RIGHT THUMB	
RIGHT FOUR FINGERS					

G-155-Sub-7/18/62

MRC 4/24/63

(25) June 10, 1962. Two-page handwritten letter to The "Worker."

Exhibit No. 1  
on Elimination  
of the "Worker," Johnson  
23 W 26th St. 4/12/64

24 E 5th St  
Rt. Box 30061  
NEW Orleans, La

J.P.R.  
B.F.

Dear Sir,

As a long time subscriber  
to the Worker I know I can  
ask a favor of you with full  
confidence of its fulfillment

I have formed a "Fair Play  
for Cuba Committee" here in  
New Orleans, I think it is  
the best way to attract the  
large mass of people to a  
popular struggle.

A. Johnson  
Exhibit #1

I ask that you give  
me as much literature as you  
judge possible since I think  
it would be very nice to have  
your literature among the "Fair  
Play" leaflets (like the one enclosed)  
in my office.

Also please be as kind as

to convey the enclosed "housing  
membership" cards to those  
fighters for peace Mr. Gus Hall  
and Mrs. E. Davis.

Yours Truly,  
Leo H. Gurr  
June 18, 1962

# HANDS OFF CUBA!

Join the Fair Play for  
Cuba Committee

NEW ORLEANS CHARTER  
MEMBER BRANCH

*Free Literature, Lectures*

**LOCATION:**

A. Johnson  
Exhibit #1

**EVERYONE WELCOME!**



(26) July 13, 1962. Letter to Leslie Welding Co., signed Lee H. Oswald; written on part of a page from a yellow legal pad. Blue ink; ballpoint pen. Location: Archives.

Leslie Welding Co.  
210 N. Fifth Street  
Fort Worth, Texas  
To Tom Yates Foreman.

Dear Sir;

This is to explain that I have moved permanently to Dallas, Texas, where I have found other employment.

I ask that my check for work performed during the week Oct. 1-8 be forwarded to me now, and the other check coming to me from my first week of work be forwarded as soon as possible.

I further request that my name be withdrawn from those whom you presently employ.

Very respectfully,  
Lee H. Oswald

LEE H. OSWALD

Box 2915

Dallas,  
Texas

46-129 304

See  
D-18

(27) October 9, 1962. Application for Post Office Box No. 2915, signed Lee H. Oswald.

FOR POST OFFICE USE ONLY	POSTMASTER M. B. 10520	DATE BOX OPENED OCT 9 - 1962	DATE BOX CLOSED MAY 14 1963	BOX NO. 2915
--------------------------------	---------------------------	---------------------------------	--------------------------------	-----------------

APPLICANT PLEASE NOTE: Completion of this application signifies your willingness to comply with all postal rules relative to the renting and use of Post Office boxes.

NAME OF APPLICANT (Print or type)  
LEE H. OSWALD

NAME OF FIRM OR CORPORATION (If box is rented for use of either)

KIND OF BUSINESS

BUSINESS ADDRESS (No., street, and zone)  
(D-17)

HOME ADDRESS (No., street, and zone)  
3519 FAIRMORE BL. Dallas TX

SIGNATURE OF APPLICANT  
X Lee H. Oswald

DATE OF APPLICATION  
Oct 9, 1962

**For Post Office Use Only**  
ENTERED IN DIRECTORY



INITIALS OF CLERK

*ve*

INITIALS OF CARRIER

BOX NO.

*6225-*

**THE FOLLOWING MUST BE COMPLETED AND SIGNED BEFORE P.O. BOX IS ASSIGNED**

DELIVER MAIL IN ACCORDANCE WITH INSTRUCTIONS CHECKED BELOW

☐ ALL EXCEPT SPECIAL  
DELIVERY IN BOX

☒ ALL INCLUDING SPECIAL  
DELIVERY IN BOX

☐ OTHER INSTRUCTIONS  
(*Explain*)

☐ ONLY MAIL ADDRESSED TO BOX IS TO BE PLACED IN IT.  
ALL OTHER MAIL TO BE DELIVERED AS ADDRESSED.

SPECIAL DELIVERY MAIL ONLY (*Deliver as checked below*)

☐ DELIVER TO LOCAL RESIDENCE AT

☐ DELIVER TO LOCAL BUSINESS ADDRESS AT

(No., street, and zone)

(No., street, and zone)

NAMES OF PERSONS ENTITLED TO RECEIVE MAIL THROUGH BOX (*If box is rented to a firm, include the full name of each of its members whose mail is to be placed in box.*)

☐ HAVE READ ITEMS 1 THROUGH 5, ABOVE AND  
WILL COMPLY WITH THEM.

**X**

*Lee H. Daniel*  
(Signature of applicant)

POD FORM 1093  
JULY 1960

APPLICATION FOR POST OFFICE BOX

U.S. GOVERNMENT PRINTING OFFICE 16-47420-7

*2-17*

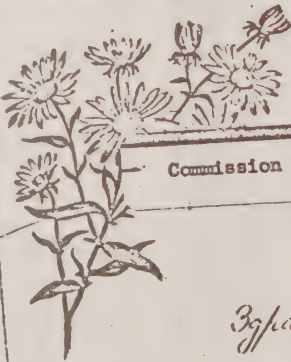
(28) March 8, 1963. Photocopies of a note in Russian to Ruth Paine from Marina Oswald. Location: Archives. (CE 404)

Mrs. Marina Oswald  
214 Neely  
Dallas, TEXAS



Comm-Ex. 404 R.

Mrs. Ruth Paine  
2515 West Fifth street  
Irving, TEXAS.



Марина БС  
Dallas

Commission Exhibit No. 404

Здравствуйте, Рут!

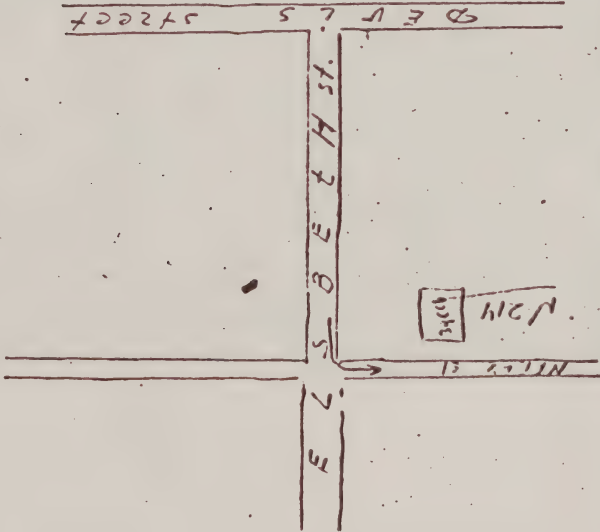
Вчера получила от Вас пись-  
мо и очень обрадовалась,  
что нас не забыли. Обещаю,  
но приезжайте к нам. В  
любое время с утра, как  
вам будет. Думаю, что можно

Commission Exhibit No. 404



(29) March 12, 1963. United States Postal Money Order #2,202,130,462.

Дан  
всё  
адрес:  
214



Не вступил, так он не знает.  
 и не было вступилу  
 и мне ничего нечего уфай  
 в доме. Так это не знает.  
 меня похвалу, то так  
 нагало отложила наду  
 вступилу. Буря риза вступилу.  
 Вас с детьми.  
 А пока пишу.  
 По дугам.  
 Буря рас спасибо, что не  
 закончил. Успехи  
 Нарина одобро.

015979

221  
DOLLARS CENTS

2,202,130,462

## U. S. Postal Money Order

PAY TO  
AMOUNT

WARNING

15-119  
000NOT VALID  
OR MORE THAN

THIRTY DOLLARS

PURCHASER—FILL IN INFORMATION BELOW

DO NOT  
CASH IF  
ALTERED

PAY TO

Klein's Sporting Goods

FROM

A. Tidell

PURCHASER'S NAME

IF  
C.O.D.  
ENTER  
NO.  
HERE

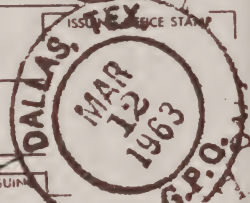
P.O. Box 2915

PURCHASER'S STREET ADDRESS

Dallas, Texas

PURCHASER'S CITY AND STATE

DO NOT FOLD, STAPLE, SPINDLE OR MUTILATE

INITIAL OF ISSUING  
OFFICE

PAYEE MUST ENDORSE BELOW ON LINE MARKED "PAYEE"

OWNERSHIP OF THIS ORDER MAY BE TRANSFERRED TO ANOTHER PERSON OR FIRM IF THE PAYEE WILL WRITE THE NAME OF SUCH PERSON OR FIRM ON THE LINE MARKED "PAY TO" BEFORE WRITING HIS OWN NAME ON THE SECOND LINE. MORE THAN ONE ENDORSEMENT IS PROHIBITED BY LAW. BANK STAMPS ARE NOT REGARDED AS ENDORSEMENTS.

CAUTION

PAY TO THE ORDER OF

The First National Bank of Chicago

PAY TO

50 91144

KLEIN'S SPORTING GOODS, INC.

RHJ 11-23-63  
 JHM 11-23-63  
 DEP 11-23-63  
 GAY 11-24-63

THIS ORDER BECOMES INVALID AFTER 20 YEARS.  
 THEREAFTER NO CLAIM FOR PAYMENT WILL BE CONSIDERED.





- (31) May 4, 1963. Photograph of man with rifle and newspapers. On the back of the photograph is a handwritten notation reading "To my friend George from Lee Oswald 5/IV/63" and, in Russian, the statement "Copyright G de M." Also in Russian is writing which translated as "Killer of Fascists—Ha-Ha-Ha !!!"



1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

DATE 8-3-73 133-A DEM

MISSOURI POLICE DEPARTMENT

2009 146K 30

Годы 18, 18, 18

$$x^2 - x - 2 = (x-2)(x+1)$$

Copyright  
C. de M.



133-A DEM

DATE 8-3-78

(32) May 26 (1963). \* Two-page letter to Fair Play for Cuba Committee.

Exhibit NO 2  
an deposer of V.T. May 26  
Lee, 4/17/64 at New

Dear Sirs 4/18/64 N.Y. J. L. R.  
V. T. L.

I am requesting formal  
membership in your organization.

In the past I have received  
from you pamphlets ect., both  
bought by me and given to me  
by you.

now that I live in New  
Orleans I have been thinking  
about renting a small office  
at my own expense for the  
purpose of forming a F.P.C.C.  
branch here in New Orleans.

could you give me a  
charter?

also I would like information  
on buying pamphlets ect. in  
large lots, as well as blank  
F.P.C.C. applications ect.

V. T. Lee  
Exhibit #2

also, a picture of Fidel,  
suitable for framing would be

most welcome touch.

Offices down here rent for 30. a month and if I had a steady flow of literature I would be glad to take its expense.

Of course I work and could not supervise the office at all times but I'm sure I could get some volunteers to do it.

could you add some advice or recommendations?

I am not saying this project would be a roaring success, but I am willing to try.

an office, literature, and getting people to know you are the fundamentals of the F.P.C.C. as far as I can see so here's hoping to hear from you.

Yours respectfully  
Lee A. Brown



(33) June 15, 1963. Fair Play for Cuba Committee, New Orleans Chapter.

**FAIR PLAY FOR CUBA COMMITTEE  
NEW ORLEANS CHAPTER**

**L. H. OSWALD**

Name

*La W. Oswald*

Signature

**JUN 15 1963** *P. J. Hittell*


Issued

Chapter President

(Reverse side is blank.)

(34) June 25, 1963. Passport application, signed Lee H. Oswald.

(35) June 24, 1963. Passport photograph attached to item 34, signed Lee H. Oswald. Blue ink; ballpoint pen. Location: Archives.

DEPARTMENT OF STATE PASSPORT APPLICATION		(Passport Office Use Only)	
(Before Completing this Application, Read Information for Passport Applicants on Page 4)		D 0 9 2 5 2 F	
PART I - TO BE COMPLETED BY ALL APPLICANTS			
1. (First name) <u>LEE</u> (Middle name) <u>HENRY</u> (Last name) <u>OSWALD</u> , a citizen of the United States, do hereby apply to the Department of State for a passport.		PASSPORT ISSUED	
MAIL PASSPORT TO		JUN 25 '63	
STREET <u>PO BOX 30061</u>		DEPARTMENT OF STATE	
CITY <u>NEW ORLEANS</u> STATE <u>LA</u>		NEW ORLEANS, LA.	
IN CASE OF (IF NECESSARY)			
DATE OF BIRTH (Month, day, year)	PLACE OF BIRTH		
<u>SEP 17 1939</u>	<u>NEW ORLEANS, LA</u>		
HEIGHT <u>5</u> FT <u>10</u> IN	HAIR <u>BRN</u>	EYES <u>GRN</u>	APPROXIMATE DATE OF DEPARTURE <u>SEP 10 1963</u>
VISIBLE DISTINGUISHING MARKS <u>NONE</u>		OCCUPATION <u>Photographer</u>	
MY PERMANENT RESIDENCE (Street address, City, State) (If same as in mailing block, write "Same") <u>2017 PINE ST NEW ORLEANS, LA</u>		COUNTY OF RESIDENCE <u>USA</u>	
PERSONS TO BE INCLUDED IN PASSPORT			
This section to be completed only if wife or husband is to be included in applicant's passport (Include photographic likenesses in group photo)			
(WIFE'S) (HUSBAND'S) FULL LEGAL NAME			
(WIFE'S) (HUSBAND'S) LAST U. S. PASSPORT WAS OBTAINED FROM			
LOCATION OF ISSUING OFFICE	DATE OF ISSUANCE	NUMBER	
		SUBMITTED HEREWITH <input checked="" type="checkbox"/> (If not submitted, write "Not")	
This section to be completed only if children are to be included in applicant's passport (Include photographic likenesses in group photo)			
NAME IN FULL	PLACE OF BIRTH (City, State)	DATE OF BIRTH	RESIDED IN THE U. S. FROM TO
C STAPLE ONE PHOTO BELOW DO NOT MAR FACE		HAVE YOU PREVIOUSLY APPLIED FOR A U. S. PASSPORT? (If answer is "Yes", complete box below)	
		<input type="checkbox"/> YES <input type="checkbox"/> NO	
MY LAST U. S. PASSPORT WAS OBTAINED FROM (Name: If included in another's passport, state name here):		DATE OF ISSUANCE	
LOCATION OF ISSUING OFFICE <u>LOS ANGELES, CALIF</u>		<u>SEP 10, 1959</u>	
NUMBER <u>1732282 C + A - 7</u>			
<input checked="" type="checkbox"/> SUBMITTED FOR CANCELLATION			
<input type="checkbox"/> OTHER			
Commission Exhibit No. 781			
JUN-24-63 600004		LIT:ATI 9.00	
(Passport Office Use Only)			
FEE <u>1</u> EXEC <u>1</u> TAX <u>1</u> POST <u>1</u>		JUN-24-63 600004 LIT:ATI 1.00	
FORM DSP-11 5-62		PAGE F-901a	
(OVER - YOU MUST COMPLETE PAGE 2)			

FORM DEP-11 5-62

(PART I - Continued)

PAGE 5

FATHER'S NAME <i>ROBERT LEE FRANK</i>	FATHER'S PLACE OF BIRTH <i>NEW YORK</i>	FATHER'S DATE OF BIRTH <i>1895</i>	<input checked="" type="checkbox"/> U. S. CITIZEN <input type="checkbox"/> NOT U. S. CITIZEN
MOTHER'S MAIDEN NAME <i>MARION L. FRANK</i>	MOTHER'S PLACE OF BIRTH <i>NEW YORK</i>	MOTHER'S DATE OF BIRTH <i>1907</i>	<input checked="" type="checkbox"/> U. S. CITIZEN <input type="checkbox"/> NOT U. S. CITIZEN

<input type="checkbox"/> I WAS NEVER MARRIED <input checked="" type="checkbox"/> I WAS LAST MARRIED ON <i>APRIL 31 1961</i> WHO WAS BORN AT <i>NEW YORK</i> ON (Date of birth) <i>JULY 17, 1941</i>		TO (Full legal name - complete whether widowed or divorced) <i>MARION PRESSAROVA</i>	
<input type="checkbox"/> WHO IS A U. S. CITIZEN <input type="checkbox"/> WHO IS NOT A U. S. CITIZEN <input checked="" type="checkbox"/> I WAS NEVER PREVIOUSLY MARRIED <input type="checkbox"/> I WAS PREVIOUSLY MARRIED ON <i>1</i> WHO WAS BORN AT <i>NEW YORK</i> ON (Date of birth) <i>JULY 17, 1941</i>		<input type="checkbox"/> MARRIAGE NOT TERMINATED <input type="checkbox"/> MARRIAGE TERMINATED BY (DEATH) (DIVORCE) ON <i>1</i> TO (Full legal name) <i>NEW YORK</i> ON (Date of birth) <i>JULY 17, 1941</i>	
<input type="checkbox"/> FORMER HUSBAND OR WIFE WAS U. S. CITIZEN <input type="checkbox"/> FORMER HUSBAND OR WIFE WAS NOT U. S. CITIZEN		PREVIOUS MARRIAGE TERMINATED BY (DEATH) (DIVORCE) ON <i>1</i> ON <i>NEW YORK</i>	

(IF MARRIED MORE THAN TWICE, SET FORTH FACTS IN A SUPPLEMENTAL STATEMENT)

PROPOSED TRAVEL PLANS		PURPOSE OF TRIP <i>TRIP</i>	LIST EACH COUNTRY TO BE VISITED <i>ENGLAND FRANCE GERMANY HOLLAND USSR FINLAND ITALY POLAND</i>
TRAVELING BY ORGANIZED TOUR? <i>YES</i>			
PORT OF DEPARTURE <i>NEW YORK</i>	APPROXIMATE DATE OF DEPARTURE <i>1961</i>		
NAME OF SHIP OR AIRLINE <i>EVANS LINE</i>	NUMBER OF PREVIOUS TRIPS ABROAD WITHIN LAST 12 MONTHS <i>1</i>		
MEANS OF TRANSPORTATION		PROPOSED LENGTH OF STAY <i>3 MONS - 1 YR.</i>	
PLEASE INDICATE WHETHER YOU EXPECT TO TAKE ANOTHER TRIP ABROAD <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> YEAR <input type="checkbox"/> 1 YEAR <input type="checkbox"/> 5 YEARS			

IN THE EVENT OF DEATH OR ACCIDENT NOTIFY		RELATIONSHIP	STREET ADDRESS, CITY, STATE
NAME IN FULL <i>LILLIAN M. FRANK</i>		<i>DAUGHTER</i>	<i>750 E. 12th St. New York 100</i>

I have not (and no other person to be included in the passport has), since acquiring United States citizenship, been naturalized as a citizen of a foreign state; taken an oath or made an affirmation or other formal declaration of allegiance to a foreign state, entered or served in the armed forces of a foreign state, accepted or maintained the status of an office, post, or employment under the government of a foreign state or political subdivision thereof, voted in a political election in a foreign state or participated in an election or plebiscite to determine the sovereignty over foreign territory, made a formal renunciation of nationality either in the United States or before a diplomatic or consular officer of the United States in a foreign state, ever sought or claimed the benefits of the nationality of any foreign state, been convicted by a court or court martial of competent jurisdiction of committing any act of treason against, or attempting by force to overthrow, or bearing arms against, the United States, or was spying in violation of, put down or to destroy by force, the Government of the United States, or departed from or remained outside of the jurisdiction of the United States for the purpose of evading or avoiding training and service in the military, air or naval forces of the United States, and I am not and have not been at any time during the period of 12 full calendar months preceding the date of this application in and no other person to be included in the passport is or has been at any time during the said period) a member of any organization registered or required to register as a Communist organization under Section 7 of the Subversive Activities Control Act of 1950, as amended. (50 U.S.C. 786)

(If any of the above-mentioned acts or conditions have been performed by or apply to the applicant, or to any other person to be included in the passport, the portion which applies should be struck out and a supplementary explanatory statement under oath (for affirmation) by the person to whom the portion is applicable should be attached and made a part of this application.)

I solemnly swear (or affirm) that the statements made on all the pages of this application are true and that the photograph attached is a likeness of me and of those persons to be included in the passport.

## OATH OF ALLEGIANCE

Further, I do solemnly swear (or affirm) that I will support and defend the Constitution of the United States against all enemies, foreign and domestic; that I will bear true faith and allegiance to the same; and that I take this obligation freely, without any mental reservation, or purpose of evasion; So help me God.

(To be signed by Applicants in presence of a Clerk of Court or Passport Agent)

Subscribed and sworn to (affirmed) before me this *1961* day of *July*, 19 *1961*

(SEAL OF COURT) *1961* Clerk of the Court at *NEW YORK*

\* See paragraph 6 of instructions

(36) August 9, 1963. Fingerprint identification card of New Orleans Police Department, signed Lee H. Oswald.

LEAVE THIS SPACE BLANK 327-925-17		-JFK EXHIBIT F-400 a		MALE	
SIGNATURE OF PERSON FINGERPRINTED <i>L. H. Oswald</i>		LAST NAME OSWALD		FIRST NAME LEE	MIDDLE NAME HARVEY
CONTRIBUTOR AND ADDRESS SUPERINTENDENT POLICE DEPARTMENT NEW ORLEANS, LA.		ALIASES		HT. (Inches) 5-9	WT. 136
YOUR NUMBER 112-723		LEAVE THIS SPACE BLANK		HAIR Br	EYES Br
SCARS AND MARKS None		AMPUTATION		DATE OF BIRTH 10-18-39	
SIGNATURE OF OFFICIAL TAKING FINGERPRINTS Arthur M James		DATE 8-9-63		PLACE OF BIRTH N.O. La.	
CLASS 15 I 25 W 100		PLACE FBI NUMBER HERE		L 21 U 000 16	
REF		CHECK IF NO REPLY IS DESIRED			
1. LEFT INDEX		2. LEFT MIDDLE		3. LEFT RING	
4. LEFT LITTLE		5. RIGHT INDEX		6. RIGHT MIDDLE	
7. RIGHT RING		8. RIGHT LITTLE		9. LEFT THUMB	
10. LEFT FOUR FINGERS TAKEN SEPARATELY		11. LEFT THUMB		12. RIGHT THUMB	
13. LEFT FOUR FINGERS TAKEN SIMULTANEOUSLY		14. LEFT THUMB		15. RIGHT THUMB	
16. LEFT FOUR FINGERS TAKEN SIMULTANEOUSLY		17. LEFT THUMB		18. RIGHT THUMB	




**FEDERAL BUREAU OF INVESTIGATION, UNITED STATES DEPARTMENT OF JUSTICE**  
**WASHINGTON, D.C.**

**CURRENT ARREST OR RECEIPT**











<b>DATE ARRESTED OR RECEIVED</b>  8-9-63	<b>CHARGE OR OFFENSE</b> <small>(If code citation is used it should be accompanied by charge)</small>  828 MCS 42-22 dist the peace by creatin a scene	<b>DISPOSITION OR SENTENCE</b> <small>(List FINAL disposition only. If not now available, submit later on FBI Form R-84 for completion of record.)</small>
<b>OCCUPATION</b>  Mechn.	<b>RESIDENCE OF PERSON FINGERPRINTED</b>  4907 Magazine St	
If COLLECT wire reply or COLLECT telephone reply is desired, indicate here <input type="checkbox"/> Wire reply <input type="checkbox"/> Telephone reply Telephone number _____		FOR INSTITUTIONS USE ONLY  Sentence expires _____
<p align="center"><b>Please Paste Photograph in This Space</b></p> <p>Since photograph may become detached indicate name, FBI number, and arrest number on reverse side whether attached to fingerprint card or submitted later.</p>		<b>INSTRUCTIONS</b> 1. FORWARD ARREST CARDS TO FBI IMMEDIATELY AFTER FINGERPRINTING FOR MOST EFFECTIVE SERVICE. 2. TYPE or PRINT all information. 3. Note amputations in proper finger squares. 4. REPLY WILL QUOTE ONLY NUMBER APPEARING IN THE BLOCK MARKED "YOUR NO." 5. Indicate any additional copies for other agencies in space below—include their complete mailing address.  SEND COPY TO _____ <div style="border: 2px solid black; padding: 5px; transform: rotate(-5deg); display: inline-block;"> <b>RECORDED</b>  <b>AUG 12 1963</b>  <b>IDENT. DIV. 4</b> </div>

(37) August 9, 1963. Photocopy of fingerprint card and attached mug shots, New Orleans Police Department, signed Lee H. Oswald.

Commission Exhibit 1413



MASTER  
LEE HARVEY OSWALD (M) 112-723 591676 15 I 25 W 100 WHITE  
4 21 U 000 14

Residence  
Occupation  
Place of Birth  
Build  
Complexion  
Hair  
Eyes  
Birth Date  
Age  
Height  
Weight  
AMJ

1967 Magazine St.  
Tech.  
N.O.La.  
SLENDER  
RUDDY  
BROWN  
BROWN  
10-18-39  
23  
136  
5-9

RECEIVED  
AUG 14 1963

Arr; 1st Dist 8-9-63 by Lt. W. Gaillot etc  
Cng; 1st 828 MCS 42-22 dist the peace by creating a scene.

Date  
Taken

Signature

Lee H. Oswald

ITEM #37

Bureau of Identification, Police Department, New Orleans, La.

(38) August 28, 1963. Handwritten letter to Central Committee C. P. (Communist Party), U.S.A.

W. H. Lawrence  
 1011, 3000  
 New Orleans, La.

A. Johnson  
 Exhibit #4

Central Committee  
 C. P., U.S.A.

August 28, 1963

Amie  
 please  
 reply

W. H. Lawrence

Thank you for your letter  
 regarding my personal tactics.

I have lived in the Soviet  
 Union from Oct. 1956 to July 1962.

I had, in 1959, in Moscow, tried  
 to legally dissolve my United  
 States citizenship in favor of Soviet  
 citizenship; however, I did not  
 complete the legal formalities for this.

Having come back to the U.S.  
 in 1962 and thrown myself  
 into the struggle for progress  
 and freedom in the United  
 States, I would like to know  
 exactly, in your opinion, I can  
 continue to fight, handicapped as  
 I am, by my past record, can  
 I not be considered an untrustworthy comrade

the repressive forces, above-  
ground or whether in your opinion  
I should always remain in the  
background, i.e. underground.

Our opponents could and my  
background of work in the  
U.S.S.R. against our cause which  
I join, by association, they could  
say the organization of which I  
am a member, is Russian controlled,  
etc. I am sure you see my  
point.

I could of course openly declare,  
if pressed on the subject that  
I wanted to dissolve my American  
citizenship as a personal protest  
against the policy of the U.S. government  
in supporting dictatorships, etc.

But what do you think I should



is it which is the best tactic  
and gradual?

Should I discontinue my part of former  
all progressive activities?

During this summer, I am  
secretary of the local branch of  
the "New Negro For Cuba Committee",  
a position which, frankly, I share  
with the poets, communist ideologues.  
On a local radio show, I was  
attacked by Cuban life's organization  
representatives for my residence act;  
and the Soviet Union. I P

I feel I may have compromised  
the N.P.C.C., so you see that  
I need the advice of trusted,  
long time fighters for progress.  
Please advise.

With affectional greeting  
Sincerely

Lee H. Caldwell

(39) September 27, 1963. Photocopy of a page from a hotel register.



Viernes. 27 de septiembre 1963

Nº	Nombres	Procedencia	Empaques	Notas
1	Jr. Isabel Sahar	Durango	Empaques	
2	Gregorio Guadalupe	Durango	Empaques	
3	Pablo Durango	Guadalupe	Empaques	
4	Antonio Abila	D.F.	Empaques	
5	Manuel Guayana	U. Laredo	Empaques	
6	Fernando Valenzuela	El Estero	Empaques	
7	Angelica Guayana	Torreón	Empaques	
8	Francisco Morales	Rioverde	Empaques	
9	María Guadalupe	El Estero	Empaques	
10	José Luis Guadalupe	Chihuahua	Empaques	
11	Pedro Guadalupe	Torreón	Empaques	
12	Manuel Santos	Saltillo	Empaques	
13	Rafael Pech	Torreón	Empaques	
14	Guadalupe Contreras	Guadalupe	Empaques	
15	Guadalupe Guadalupe	San Luis	Empaques	
16	Rodolfo Rodríguez	Chihuahua	Empaques	
17	Rodolfo Rodríguez	Chihuahua	Empaques	
18	Don. Jorge Guadalupe	U.S.A. Texas	Empaques	US citizen
19	Pedro Guadalupe	St. Pete	Empaques	
20	Donato Pech	Leon	Empaques	
21	María Guadalupe	Saltillo	Empaques	
22	Roberto Lopez	D.F.	Empaques	
23				
24	Juan Fco Pech	Durango	Empaques	
25	Osorio Lora	Monterrey	Empaques	
26	Alfredo Guadalupe	Guadalupe	Empaques	
27				
28	José Guadalupe	Guadalupe	Empaques	
29	Manuel Guadalupe	Monterrey	Empaques	
30				

(40) September 27, 1963. Photographs (one of the entire document and one of the signature) of the original of the visa application, Cuban Consulate, Mexico City, signed Lee H. Oswald. (Shown here is only the photograph of the entire document.)



27-16-1941-2544-10-1943.

4444 45 46 47 48

Ficha 1-6 d. nome e sobrenome

1990-1991

October 14.

Diacci 2. 1000000

1997

— — — — —

Ocupación (aprovechando empresas para las que trabajo)

\_\_\_\_\_

Estaciones interiores en Cuba

### Motivos de las estancias anteriores

Familiars o personas conocidas residentes en Cuba

Ha sido invitado desde Cuba? (Si: ) (No: )

Con que objeto?

Qual é o motivo ~~de~~ da viaje proposta

State of Illinois - 1900

1997-1998

1943

Dirección de la Oficina:

1942-1943

7th mo det. interrogated

PARA USO DE LA MISIÓN

WATER, CHINA

[illegible]

... 1901

JFK 4/10/67 F. 407

(41) September 27, 1963. Photograph of the carbon copy of item 40, shown to the Select Committee staff when they met with President Fidel Castro in Havana, Cuba, with an original signature, Lee H. Oswald.



ESTADO DE CUBA, MEXICO, D.F.

Solicitud de visa No. 779

Echos: 10 OCT 1963

Nombres: Lee Harvey Oswald

Nacionalidad: Estadounidense

Echada y lugar de nacimiento: 6 OCT 1939

Pasaporte No. 7-11111

Residencia: 1000 G Street, N.W., Wash. D.C.

Ocupación (aprovechando empresa para la que trabaja): Empleado de la Marina

Estancias anteriores en Cuba: ---

Motivos de las estancias anteriores: ---

Relaciones o personas conocidas residentes en Cuba: ---

10 OCT 1963

¿Se ha investigado desde Cuba? (SI: ) (NO: )

¿Con qué objeto? ---

¿Cuál es el motivo del viaje propuesto? Trabaja en la Marina

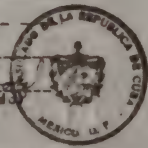
¿Presenta? ---

¿Cuánto tiempo? 2 SEMANAS

Fecha propuesta de llegada a Cuba: 10 OCT 1963

Residencia en Cuba: ---

Lee H. Oswald  
(Firma del interesado)



PARA USO DE LA MISION

INFORMACIONES: El interesado, Lee Harvey Oswald, al P.C. y al Secretario de la Mision...  
El interesado, Lee Harvey Oswald, al P.C. y al Secretario de la Mision...  
El interesado, Lee Harvey Oswald, al P.C. y al Secretario de la Mision...  
El interesado, Lee Harvey Oswald, al P.C. y al Secretario de la Mision...  
El interesado, Lee Harvey Oswald, al P.C. y al Secretario de la Mision...  
El interesado, Lee Harvey Oswald, al P.C. y al Secretario de la Mision...  
El interesado, Lee Harvey Oswald, al P.C. y al Secretario de la Mision...  
El interesado, Lee Harvey Oswald, al P.C. y al Secretario de la Mision...  
El interesado, Lee Harvey Oswald, al P.C. y al Secretario de la Mision...  
El interesado, Lee Harvey Oswald, al P.C. y al Secretario de la Mision...

Alfonso



(42) October (no date), 1963. Letter to the Russian Embassy. Location: Archives. (FBI D-441321 AX Q49; CE 103; JFK F-500).

— Exhibit 67 for identification

— Commission Exhibit 103

Dear Sirs.

This is to inform you of ~~my~~ <sup>my</sup> interviews with ~~conrad~~ <sup>conrad</sup> Koutine in the Embassy of the Soviet Union Mexico City, Mexico.

I was unable to remain in Mexico City ~~because~~ <sup>I was unable to remain</sup> indefinitely because of my ~~visa~~ <sup>Mexican visa</sup> restrictions which was for 15 days only, ~~so that~~ <sup>so that</sup> I could not ~~apply for~~ <sup>apply for</sup> an extension ~~unless~~ <sup>unless</sup> I used my real name as I ~~returns~~ <sup>returns</sup> to the U.S., and ~~my~~ <sup>my</sup> name ~~Nichols~~ <sup>Nichols</sup> are now living in Dallas, Texas, ~~and~~ <sup>and</sup> ~~attending~~ <sup>attending</sup> the

The FBI is not now interested in my activities in the progressive organization, F.P.C.C. of which I was secretary in ~~New Orleans~~ <sup>New Orleans</sup> ~~and~~ <sup>and</sup> Louisiana since I ~~am~~ <sup>am</sup> no longer ~~connected~~ <sup>connected</sup> ~~with~~ <sup>with</sup> that State.

~~However, at~~ <sup>However, at</sup> the FBI has ~~visited~~ <sup>visited</sup> us here in Texas on Nov. 1st. a agent of the FBI James P. Hasty warned me that if I attempted to engage in F.P.C.C. activities in Texas the FBI will again take an "interest" in me. He also "suggested" that my wife could remain in the U.S. under FBI protection, that is, she could ~~depart from~~ <sup>depart from</sup> ~~the~~ <sup>the</sup> Soviet Union of course I and my wife strongly protested

these tactics by the notorious F.B.I.

~~never~~ It was unfortunate that the Soviet  
Embassy was unable to aid me in Mexico City  
~~but~~ I had not planned to contact the Mexican City  
Embassy at all so of course they were unprepared for  
me & had I been able to reach Havana no planned  
I could have contacted the Soviet Embassy there  
~~for the completion of~~ would have been able to  
~~help me~~ get the necessary documents I required.  
~~assist me~~. would have had the time to assist  
me. but of course the ~~stupid~~ stupid Cuban Consul  
was at fault here, I'm glad he has since been  
replaced by another.

(43) October 15, 1963. Employment application, with face sheet signed Lee H. Oswald.

Pres. A.H. Lee H. 2515 W. 5th St. Irving

64 31628

433-543937 23 1150

New Orleans, La

Continuously

11th

Arlington Heights Ill. 10th, 1961

no

C

2 dependents

U.S.M.C. (three year)

air wing

Honorable discharge

Three years

Dead

eyes

Practical nurse

children

ANSWER YES OR NO

no

no

no

clerical (accounting) work in military service, experienced with Dicto, adding and some typing machine and filing system

Oct. 15, 1963

Lee H. Oswald

D-2

(44) October 16, 1963. Employee's W-4 Withholding Exemption Certificate.

FORM W-4 (Rev. July 1961)  
U. S. Treasury Department  
Internal Revenue Service

# EMPLOYEE'S WITHHOLDING EXEMPTION CERTIFICATE

Print full name LEE HARVEY OSWALD Social Security Account Number 433-54-3932  
Print home address 2515 West 5th St City IRVING Zone State TEXAS

## EMPLOYEE:

File this form with your employer. Otherwise, he must withhold U. S. Income tax from your wages without exemption.

## EMPLOYER:

Keep this certificate with your records. If the employee is believed to have claimed too many exemptions, the District Director should be so advised.

## HOW TO CLAIM YOUR WITHHOLDING EXEMPTIONS

1. If SINGLE, and you claim an exemption, write the figure "1" . . . . .
2. If MARRIED, one exemption each is allowable for husband and wife if not claimed on another certificate.  
 (a) If you claim both of these exemptions, write the figure "2"  
 (b) If you claim one of these exemptions, write the figure "1"  
 (c) If you claim neither of these exemptions, write "0" . . . . . 2
3. Exemptions for age and blindness (applicable only to you and your wife but not to dependents):  
 (a) If you or your wife will be 65 years of age or older at the end of the year, and you claim this exemption, write "1"; if both will be 65 or older, and you claim both of these exemptions, write "2" . . . . .  
 (b) If you or your wife are blind, and you claim this exemption, write the figure "1"; if both are blind, and you claim both of these exemptions, write the figure "2" . . . . . 2
4. If you claim exemptions for one or more dependents, write the number of such exemptions. (Do not claim exemption for a dependent unless you are qualified under instruction 4 on other side.) . . . . . 3
5. Add the number of exemptions which you have claimed above and write the total . . . . . 4
6. Additional withholding per pay period under agreement with employer. See Instruction 1 . . . . . \$

I CERTIFY that the number of withholding exemptions claimed on this certificate does not exceed the number to which I am entitled

(Date) Oct 16 . . . . ., 1963 (Signed) Lee Harvey Oswald

645-10-71908-2



(45) November 1, 1963. Application for Post Office Box 6225, two cards, each signed Lee H. Oswald. Blue ink; ballpoint pen. Location: Archives. (CE 792; JFK F-495)

FOR POST OFFICE USE ONLY		POSTMASTER	DATE BOX OPENED NOV - 1 1963	DATE BOX CLOSED	BOX NO. 6225
<p>APPLICANT PLEASE NOTE: Completion of this application signifies your willingness to comply with all postal rules relative to the renting and use of Post Office boxes.</p>					
NAME OF APPLICANT (Print or type) LEE H. OSWALD					
NAME OF FIRM OR CORPORATION (If box is rented for use of either) FAIR PLAY FOR CUBA COMMITTEE					
KIND OF BUSINESS AMERICAN CIVIL LIBERTIES UNION					
BUSINESS ADDRESS (No., street, and zone) None Profit.					
HOME ADDRESS (No., street, and zone) 3610 N. Beckley					
SIGNATURE OF APPLICANT X Lee H. Oswald				DATE OF APPLICATION D-17 NOV. 1, 1963	

(46) November 1, 1963. Receipt for key to Post Office Box 6225, signed Lee H. Oswald. Blue ink; ballpoint pen. Location: Archives. (CE 792; JFK F-495)

Received  
Key

(1)

NOV - 1 1963

Lee H.  
Oswald

(47) November 8, 1963. Photograph of a facsimile copy of a handwritten letter to Mr. Hunt.

Nov. 8, 1963

Dear Mr. Hunt,

I would like information  
concerning my position.

I am asking only for information.  
I am suggesting that we discuss the  
matter fully before any steps are  
taken by me or anyone else.

Thank you.

Lee Harvey Oswald

(48) November 9, 1963. Photomechanical (halftone) reproduction of a type-written letter to the Consular Division, Embassy, U.S.S.R., Washington, D.C.

FROM: LEE H. OSWALD, P.O. BOX 6225, DALLAS, TEXAS  
MARINA NICHILAYEVA OSWALD, SOVIET CITIZEN

TO: CONSULAR DIVISION:  
EMBASSY U.S.S.R.  
WASHINGTON, D.C.  
NOV. 9, 1963

6125  
20-11

Dear sir;

This is to inform you of recent events since my meetings with comrade Kostin in the Embassy Of the Soviet Union, Mexico City, Mexico.

I was unable to remain in Mexico indefinitely because of my Mexican visa restrictions which was for 15 days only. I could not take a chance on requesting a new visa unless I used my real name, so I returned to the United States.

I had not planned to contact the Soviet embassy in Mexico so they were unprepared, had I been able to reach the Soviet Embassy in Havana as planned, the embassy there would have had time to complete our business.

Of course the Soviet embassy was not at fault, they were, as I say unprepared, the Cuban consulate was guilty of a gross breach of regulations. I am glad he has since been replaced.

The Federal Bureau of Investigation is not now interested in my activities in the progressive organization "Fair Play For Cuba Committee", of which I was secretary in New Orleans (state Louisiana) since I no longer reside in that state. However, the F.B.I. has visited us here in Dallas, Texas, on November 1st. Agent James P. Hasty warned me that if I engaged in F.P.C.C. activities in Texas the F.B.I. will again take an "interest" in me.

This agent also "suggested" to Marina Nichilayeva that she could remain in the United States under F.B.I. "protection", that is, she could defect from the Soviet Union, of course, I and my wife strongly protested these tactics by the notorious F.B.I.

Please inform us of the arrival of our Soviet entrance visa's as soon as they come.

Also, this is to inform you of the birth, on October 20, 1963 of a daughter, AUCREY MARINA OSWALD in DALLAS, TEXAS, to my wife.

Respectfully,

*Lee H. Oswald*



(49) July 18, 1964. Exemplar (standard) signatures and writing of Jack Ruby.  
Location: Archives.

Jack Ruby

July 18, 1964

Jack Ruby

Jack Ruby

Jack Ruby

Jack Ruby

Jack Ruby

Jack Ruby

Jack Ruby

Jack Ruby

Now is the time for all  
good men to come to the  
aid of their country

Now is the time for all  
good men to come to the  
aid of their country

Our country is in very  
serious trouble at  
this time

Written By JACK RUBY

Writ. present 7/18/64 at 9:05 pm CST

Arch. Spete



these tactics by the notorious F.B.I.

~~It was unfortunate that the Soviet~~  
~~Embassy was unable to aid me in Mexico City~~  
~~but I had not planned to contact the Mexican City~~  
~~Embassy at all so of course they were unprepared for~~  
~~me & had I been able to reach Havana as planned~~  
~~I could have contacted the Soviet Embassy there~~  
~~for the completion of which I would have been able to~~  
~~get the necessary documents I required.~~  
~~contact me.~~ I would have had the time to assist  
 me. But of course the ~~trip~~ Cuban Consul  
 was at fault here, I'm glad he has since been  
 replaced by another.

(51) Undated. Handwritten speech, nine pages.

Commission Exhibit 97

Exhibit 97 for identification

The COMMUNIST PARTY OF THE UNITED STATES HAS BETRAYED ITSELF!

IT HAS TURNED ITSELF INTO THE TRADITIONAL LEVER OF A FOREIGN POWER TO OVERTHROW THE GOVERNMENT OF THE UNITED STATES; NOT IN THE NAME OF FREEDOM OR HIGH IDEALS, BUT IN SERVILE CONFORMITY TO THE WISHES OF THE SOVIET UNION AND IN ANTICIPATION OF SOVIET RUSSIA'S COMPLETE DOMINATION OF THE AMERICAN CONTINENT.

The FORSTER'S AND <sup>THE</sup> FLYNN'S OF THE SUBSIDIZED COMMUNIST PARTY OF THE <sup>UNITED</sup> STATES HAVE SHOWN THEMSELVES TO BE WILLING, GULLIBLE MESSENGERS OF THE KREMLIN'S INTERNATIONALIST PROPAGANDA.

THERE CAN BE NO INTERNATIONAL SOLIDARITY WITH THE ARCH-BETRAYERS OF THAT MOST SUBLIME IDEAL.

THERE CAN BE NO SYMPATHY FOR THOSE WHO HAVE TURNED THE IDEA OF COMMUNISM INTO A VILL CURSE TO WESTERN MAN.

THE SOVIETS HAVE COMMITTED CRIMES UNSURPASSED EVEN BY THEIR EARLY DAY CAPITALIST COUNTERPARTS. THE IMPRISONMENT OF THEIR OWN PEOPLES, WITH THE MASS EXTERMINATION SO TYPICAL OF STALIN, AND



3

~~and~~ The individual suppression and regimentation  
under Khrushchev.

The deportations, the purposeful starvation  
of diet in the consumer slighted population  
of Russia, the murder of history, the proscription  
of art and culture.

The communist movement in the U.S.,  
personalized by the, COMMUNIST PARTY U.S.A.,  
has turned itself into a "valuable gold coin"  
of the Kremlin. It has failed to denounce  
any actions of the Soviet Government when  
similar actions on the part of the U.S. Government

bring public protest. Examples:

Condemned:

United States

Atom Bomb Test

CUBA

NATL. MANEUVERS

U-2

CCNY

newly lynching

NOT CONDEMNED:

RUSSIA

Atom Bomb Test

HUNGARY

WARSAW PACT MANEUVERS

SCHEL

EASTERN GERMANY

genocide

3

ONLY BY CELEBRATING ITSELF TO BE, NOT ONLY NOT DEPENDENT UPON, BUT OPPOSED TO, SOVIET DOMINATION AND INFLUENCE, CAN DORMANT AND DISILLUSIONED PERSONS HOPE TO UNITE TO FREE THE RADICAL MOVEMENT FROM ITS INERTIA.

THROUGH THE REFUSAL OF THE COMMUNIST PARTY U.S.A. TO GIVE A CLEAR CUT CONDEMNATION OF SOVIET PIRATE-LIKE ACTS, PROGRESSIVES HAVE BEEN WEAKEN INTO A STALE CLASS OF FIFTH COLUMNIST OF THE RUSSIANS.

IN ORDER TO FREE THE HESITATING AND JUSTIFIABLY UNCERTAIN, FUTURE ACTIVIST FOR THE WORK AHEAD WE <sup>MUST</sup> ~~NOT~~ REMOVE THAT OBSTACLE WHICH HAS SO EFFICIENTLY RETARDED HIM, NAMELY THE QUESTION OF COMMUNIST PARTY U.S.A., TO THE SOVIET UNION, SOVIET GOVERNMENT, AND SOVIET COMMUNIST INTERNATIONAL MOVEMENT.

IT IS <sup>REALITY</sup> ~~REALLY~~ FINGERED NOW THAT A COMING ECONOMIC, POLITICAL OR MILITARY CRISIS, INTERNAL OR EXTERNAL, WILL BRING ABOUT THE FINAL COLLAPSE OF THE CAPITALIST SYSTEM, ASSUMING THAT WE CAN <sup>MANIPULATE</sup> ~~MANIPULATE~~ IN A SPECIFIC PARTY LINE TO FOLLOW AN INDEPENDENT COURSE OF ACTION AS OPPOSED TO THE SOVIET, AN AMERICAN COURSE

4.

STEADFASTLY OPPOSED TO INTERVENTION BY OUTSIDE,  
RELATIVELY STABLE FOREIGN POWERS, NO MATTER  
FROM WHERE THEY COME, BUT IN PARTICULAR,  
AND IF NECESSARY, VIOLENTLY OPPOSED TO  
SOVIET INTERVENTION.

NO PARTS OF THIS TYPE CAN ~~ATTRACT~~  
ATTRACT INTO ITS RANKS MORE THAN ~~FOR A~~  
MINIMAL NUMBER OF FUNDAMENTAL RADICALS.  
IT IS NOT THE <sup>NATURE</sup> ~~NATURE~~ OF SUCH AN ORGANIZATION  
TO ATTRACT SUCH A MEMBERSHIP, AS LET'S SAY,  
THE REPUBLICANS OR EVEN THE SOCIALIST  
PARTY, BUT IT IS POSSIBLE TO ENLIST <sup>disenchanted</sup> (THE  
AID OF ~~DISSENTING~~ MEMBERS OF THE SOCIALIST  
PARTY AND EVEN SOME FROM MORE "RESPECTED")  
(FROM AN ANTI-THAIST VIEWPOINT) PARTIES.

BUT WHEREAS SUCH IDENTIFICATION ENEMIES  
150 THIS LEADLY MAN, THEY HAVE NO CONCEPT OF  
WHAT AN ANTI-THAIST MEANS.

THE <sup>FACTION</sup> ~~FACTION~~ WHICH HAS THE GREATER BASIS  
IN SOVIET AND THE MOST PRO-SOVIET AND  
RADICAL <sup>MEMBERSHIP</sup> ~~MEMBERSHIP~~ OF THE ANTI-THAIST, WILL  
BE THE DECISIVE FACTOR.

WE HAVE INTEREST IN SECURITY  
AND IN THE ANTI-THAIST, WHY SHOULD WE  
OPPOSE TO AN ANTI-THAIST WHEN THERE ARE

FAR GREATER FORCE, AT WORK, TO BRING ABOUT  
A CHANGE OF THE UNITED STATES GOVERNMENT, THAN  
WE COULD EVER POSSIBLY MUSTER.

WE DO NOT HAVE ANY INTEREST IN DIRECTLY  
ASSUMING THE LEAD OF GOVERNMENT IN THE EVENT  
OF SUCH AN UNFORTUNATE CRISIS. AS DISSENTING  
MEMBERS WE ARE MERELY INTERESTED IN  
PREVENTING REACTION INTERVENTION WHICH IS  
EASILY DRAWN  
A ~~REASONABLE~~ <sup>REASONABLE</sup> CONCLUSION IF  
ONE RELIES ON THE THEORY OF CRISIS.

THE FUNDAMENTAL OF A SEPARATE, DEMOCRATIC,  
PURE COMMUNIST SOCIETY IS OUR LOCAL, BUT  
ONE WITH OTHER COMMUNES, DEMOCRATIC  
SOCIALIZING OF PRODUCTION AND WITHOUT  
RETURN TO THE SWIFTING TART OF <sup>MARXIST</sup> ~~REASONING~~  
COMMUNISM AS OTHER POWERS.

THE RIGHTS OF PRIVATE PERSONAL <sup>PROPERTY</sup> ~~PROPERTY~~,  
RELIGION, ~~LANGUAGE~~ AND FREEDOM OF TRAVEL  
ISS (which have all been violated under Russian  
Communism) MUST BE STRICTLY OBSERVED.

TO OUR OWN AND OTHERS' INTERESTS TOWARDS  
THE WORLD AND THE WORLD THE FUTURE BETTER THAN  
ANY OTHER POSSIBLE CONSTITUTIONS OF THE TEST.

THE FUTURE OF OUR NATION IS IN THE  
HANDS OF THE PEOPLE.



BUT THESE PREFERRED TACTICS NOW, MAY PROVE  
TO BE TOO LIMITED IN THE NEAR FUTURE, THEY  
SHOULD NOT BE CONFUSED WITH SLOWNESS,  
INDISISION OR FEAR, ONLY THE INTELLECTUALLY  
FEARLESS COULD EVEN BE REMOTELY ATTRACTED TO  
OUR DOCTRINE, AND YET THIS DOCTRINE REQUIRED  
THE <sup>UTMOST</sup> ~~UTMOST~~ RESTRAINT, A STATE OF BEING  
IN ITSELF MAJESTIC IN POWER.

THIS IS STOICISM, AND YET STOICISM  
HAS NOT BEEN EFFECTED FOR MANY YEARS,  
AND NEVER FOR SUCH A <sup>PURPOSE</sup> ~~PURPOSE~~.

THERE ARE ORGANIZATIONS ALREADY  
FORMED IN THE UNITED STATES, WHO HAVE DECLARED  
THEY SHALL BECOME EFFECTIVE ONLY AFTER  
THE MILITARY DEBACLE OF THE UNITED STATES.  
ORGANIZATIONS SUCH AS THE MINUTE MEN,  
OR THE OPPOSITE OF A STOICAL ORGANIZATION.  
BUT THESE PREFERRERS ARE SIMPLY PREPARING  
TO RECKON IN THEIR OWN BACK YARD, A SYSTEM  
WHICH THEY TAKE FOR GRANTED ~~WILL BE DEFEAT~~  
MILITARILY <sup>elsewhere</sup> (THAT) TO COME FROM "PATRIOTS".

THESE MEN ARE REPRESENTED IN THE  
AMERICAN CAPITALIST SUPPORTERS. THERE WILL ALSO  
BE A SMALL GROUP OF COMMUNIST AND INDEEDLY <sup>FASCIST</sup> ~~FASCIST~~ GROUP  
THERE WILL ALSO BE A GROUP OF RADICALS

LAURENCE AT WARD-

However, the bulk of the population will not belong to any of these groups, because they will not be allowed to join any of the old nations with which we are all so familiar.

BUT THE PEOPLE WILL NEVER EXCEPT A NEW  
POLITICIANS OPPORTUNIST  
ORDER PRESENTED BY ~~THE~~ ~~OF~~ ~~OF~~  
deem

REALLY, they will <sup>deem</sup> ~~be~~ it  
necessary to ~~use~~ <sup>use</sup> a ~~new~~ <sup>new</sup> system of

NECESSARY TO HAVE THESE SYSTEM OF  
GOVERNMENT. A-G-V-T WHOM THEY HAVE BEEN  
EDUCATED. BUT THEY WILL BE ~~THE~~ AGENTS  
FORMER  
EX-PROPRIETARY ASSEMBLING THEIR ~~LAST~~ CAPITALIST  
MASTER - ALSO.

STAND FASTLY Applied To the REVENUE OF  
THE OLD FORMS They will seek NEW FORMS

... THE GOVERNMENT <sup>THE</sup> ~~MANIPULATING~~ <sup>EMPHASIS</sup>  
... MAY ~~THE~~ <sup>THE</sup> ~~WORDS~~ <sup>WORDS</sup> ...

This is where  $\rightarrow$  inference is necessary.

And certainly a well-known, but a safety  
valve, a valve for adjustment from  
within, and forcing power from without.

There will be no assistance for stabilization  
and development work. ~~It is~~ <sup>being</sup> ~~expected~~ towards  
the mid 1980s a small fund exists.

WORK IN THE KEY TO THE ~~THE~~ FUTURE door, BUT  
 FAILURE TO HAVE THAT KEY BECAUSE OF POSSIBLE  
 ARMED OPPOSITION IN OUR HYPOTHETICAL, BUT VERY  
 PROBABLE CRISIS, IS AS USELESS AS TRYING TO  
 USE FORCE NOW TO KNOCK DOWN THE door.

~~A SAFETY VALVE~~  
 ARMED LEAVES OF OUR IDEALS MUST BE  
 AN ARMED <sup>1. TRIM</sup> ~~KEY~~ AFTER THE CRISIS, JUST  
 AS ~~THE~~ <sup>AS</sup> ~~KEY~~ <sup>KEY</sup> REMAINING FROM ANY DEMONSTRATION  
 OF FORCE MUST BE CONFINED IN THE  
 MEANS TOOL.

NO MAN, HAVING KNOWN, HAVING LIVED, UNDER  
 THE RUSSIAN COMMUNIST AND AMERICAN  
 CAPITALIST SYSTEMS, COULD POSSIBLY MAKE  
 A CHOICE BETWEEN THEM, THERE IS NO CHOICE,  
 ONE OFFERS OPPRESSION THE OTHER POVERTY.  
 BOTH OFFER IMMENSE SOCIAL INJUSTICE, TINTED  
 WITH TWO BRANDS OF SLAVERY.

BUT NO RATIONAL MAN CAN TAKE THE ATTITUDE  
 OF "A LUMP OF NON-EXISTENCE". THERE ARE TWO  
 WORLD SYSTEMS, ONE TWISTED BEYOND RECOGNITION  
 BY ITS PURPOSE, THE OTHER DECADENT AND DYING  
 IN ITS FINAL POSITION.

A TRULY REPRESENTATIVE PEOPLE WOULD COMBINE THE BETTER  
 QUALITIES OF THE TWO OPEN AN AMERICAN

50

foundation, which is a world wide  
 as they are the people  
 This is the idea of simple  
 mechanism in the organization of  
 which is the organization of  
 distribution of interests and power in  
 the world of social relations  
 the idea of social relations  
 to natural measures  
 the crisis

117



- (52) Undated. Two receipts for salary from the Texas School Book Depository, signed Lee H. Oswald. (FBI Exhibit 422)

TEXAS SCHOOL BOOK DEPOSITORY  
DALLAS, TEXAS

NAME Lee H. Oswald 1/2 Month \_\_\_\_\_ Salary \$108.34  
 Less S. S. Tax 393  
 Less W. Tax —  
 Net Salary ..... \$108.34

TEXAS SCHOOL BOOK DEPOSITORY  
DALLAS, TEXAS

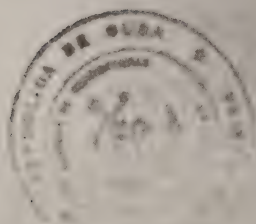
NAME Lee H. Oswald 1/2 Month \_\_\_\_\_ Salary \$108.34  
 Less S. S. Tax 393  
 Less W. Tax —  
 Net Salary ..... \$108.34

(53) Undated (August?). Photograph of Cuban identification card, Flight 751, signed Jack Ruby.

TARJETA DE IDENTIDAD/CUBA			
Nombre y Apellido <b>RUBY JACK</b>		Mant. Test. / Line <b>NMI 12</b>	
País de Nacimiento <b>USA 33</b>		País de Nacimiento <b>US 33</b>	
Edad <b>48</b>	Sexo <b>M</b>	Estado Civil <b>S</b>	Ocupación <b>MITER OF SHOPS</b>
Número de identificación del Pasajero o Travel Document			
Embarcado en Name of	Fecha Date	Visto en Issued at	Expte. Inmigración No. Imm. Expediente Number
Puerto de Embarque Port of Embarkation <b>NEW ORLEANS</b>	Empresa Transportadora Carrier <b>DELTA</b>	Vuelo No. Flight No. <b>751</b>	Fecha de Llegada Date of Arrival <b>AUG.</b>
Dirección Permanente Permanent Address <b>4727 HOMER, DALLAS TEXAS</b>			
Dirección durante la estancia en el país Address during stay in Cuba <b>CAPRI HOTEL</b>			
Turista Tourist	Transiente Transient	Residente Resident	Inmigrante Immigrant
Firma del Funcionario de Inmigración		Firma del Pasajero Passenger's Signature <b>Jack Ruby</b>	
Form. IT 36 Rev. 4-54			

TARJETA DE IDENTIDAD			
Número y Apellido Name <b>JACK RUBY</b>		Mant. Test. / Line <b>NMI 12</b>	
País de Nacimiento Country of Birth <b>USA 33</b>		País de Nacimiento Country of Birth <b>USA 33</b>	
Edad Age <b>48</b>	Sexo Sex <b>M</b>	Estado Civil Marital Status <b>S</b>	Ocupación Occupation <b>OWNER OF CIGARETTES</b>
Número de identificación del Pasajero o Travel Document			
Embarcado en Issued at	Fecha Date	Visto en Issued at	Expte. Inmigración No. Imm. Expediente Number
Puerto de Embarque Port of Embarkation	Empresa Transportadora Carrier <b>AA</b>	Vuelo No. Flight No. <b>45</b>	Fecha de Llegada Date of Arrival <b>9/12</b>
Dirección Permanente Permanent Address <b>DALLAS, TEXAS</b>			
Dirección durante la estancia en el país Address during stay in Cuba <b>CAPRI</b>			
Turista Tourist	Transiente Transient	Residente Resident	Inmigrante Immigrant
Firma del Funcionario de Inmigración		Firma del Pasajero Passenger's Signature <b>Jack Ruby</b>	
Form. IT 36 Rev. 4-54			

E-12 Sep. 59  
 Salis. 13 Sep 59



E-8 - agosto. 59  
 Salis 11. Sep. 59

(54) Undated. Exemplar writing of Marina Oswald, including seven slips of paper containing the writing "A. J. Hidell." Location: Archives, HSCA.

A. J. Hidell

A J Hidell

A. J. Hidell

A. T. Hidell

~~A. J. Hidell~~

A. J. Hidell

A. J. Hidell.

A. J. ~~Hidell~~ Hidell.

W

W

A. J. Hidell

A. J. Hidell



A. T. Hidell

A T Hidell

A. T. Hidell

A.T.Hidell

A. T. Hidell

A.T. Hidell

A. T. Hidell

A. T. Hidell

(55) Undated. Dallas Public Library card.

## YOU WILL WANT TO KNOW

1. This card may be used at any agency of the library system and must be presented when taking any materials out of the library. Ten cents will be charged for a temporary identification form if the borrower's card is not presented.
2. Each borrower is held responsible for all materials drawn on his card and for all charges accruing on the same.
3. Borrowers will please notify the library of any change of address.

THE BORROWER IS ADVISED NOT TO LEND HIS  
CARD TO ANYONE.

Name Ugwald, Mr. Lee HarveyM. Address 8024 ElabothCity Dallas Zone \_\_\_\_\_ Phone \_\_\_\_\_Signature [Signature]Address Same

City \_\_\_\_\_ Zone \_\_\_\_\_ Phone \_\_\_\_\_

School or Business Jagers-Chiles-StovalName Jack L. BowenHome Address 1916 Stevens Forest Dr.Phone WH8-8997 Expires 12-7-65

DALLAS PUBLIC LIBRARY OR

(See Reverse Side)

-TER F-505D

(56) Undated. Note in Russian, consisting of 10 lines of handwriting, signed, in Russian, "Alek."

Родился!  
 Как мне хотелось  
 чтобы не  
 было бы  
 мне уже корабля редеть на?  
 эта фото картонах мне очень  
 мне Валда и нас еще  
 кто тебе звонит сейчас?

1936

183R

133

MISSION EXHIBIT

#40

(57) Undated. Note in Russian consisting of two pages of 11 handwritten instructions concerning the Walker incident, referred to as "the Walker Note."

ко-мечет шек на дебри

6. моя одежда т.е. то моя  
вспросить или отдать не сохрани и  
но мой судья личности (военный, заварки  
и т.д. Я предпочитаю мне дереву.

7. Некоторые мои документы  
находятся в сильно маленький  
чемодане,

8. адреса я книжки на мои  
свои кабинеты. и тебе  
и да

9. Тут есть у нас друзей

10. Красный Крест может тебе  
помогать. (Red Cross (но-английский))

10. Я оставал тебе дебри как  
много так я могу, 60 и 20  
человек, и ты и Акула могут  
идти и 10 недели. еще

2 недели

11. В рели и книжки и взять мне  
мешки, порошки горюхи.  
находимся на конце той мост

через который мы всегда идем,  
когда идем к городу самый начало  
города через мост.



D-30 Dec

m. 1941

1. Эта кривая почтовой ящичку  
почтам нависла, находится городу,  
на улице ERVAU там же улице где  
аптека где таб везда стала. 4 блока  
от аптека на эту улицу и почта там  
там нависла над ящичку. Я плачу  
за ящичку прощен сейчас так ты  
не переживаешь об этом.


2. Расскажи пожалуйста информация  
что со мной случилось и можешь  
отрезать из газеты (если в газете  
что-нибудь о мне пишут) Я  
знаю что пожалуйста быстрее  
мне поскорее когда этого  
все.

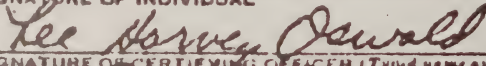
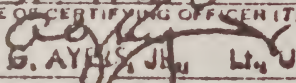
3. Я плачу за док что ты говоришь  
так не переживаешь об этом

4. За воду и газ тебе плачу не дадут


5. Возврати что деньги с работы  
будет, они пожалуйста Налли ящичку  
на почтам. нависла Сати и

(58) Undated. Certificate of Service, United States Marine Corps.

<b>CERTIFICATE OF SERVICE</b> <b>ARMED FORCES OF THE UNITED STATES</b>

THIS IS TO CERTIFY THAT <b>LEE HARVEY OSWALD 1653230</b> HONORABLY SERVED ON ACTIVE DUTY IN THE <b>United States Marine Corps</b>
<small>DO FORM 217 MC 1 JAN 54</small>

<b>PERIOD OF ACTIVE DUTY</b>	
FROM	<b>24 October 1956</b>
TO	<b>11 September 1959</b>
SIGNATURE OF INDIVIDUAL	
	
SIGNATURE OF CERTIFYING OFFICER (Typed name and grade)	
 <b>A. G. AYRES, JR. LTJ USMCB</b>	
<small>If found, drop in mail box. Postmaster: Postage guaranteed. Return to: Commandant of the Marine Corps (Code DUK), Washington 25, D.C.</small>	

(59) Undated. Social Security card, 433-54-3937, Lee Harvey Oswald; unsigned.

<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;"> <b>SOCIAL</b> ACCOUNT         </div> <div style="text-align: center;">   <b>SECURITY</b> NUMBER         </div> </div> <div style="text-align: center; margin-top: 10px;"> <b>433-54-3937</b> </div> <div style="text-align: center; margin-top: 10px;">       HAS BEEN ESTABLISHED FOR  <b>LEE HARVEY OSWALD</b> </div> <div style="text-align: center; margin-top: 10px;">       SIGNATURE _____     </div> <div style="text-align: center; margin-top: 10px; border: 1px solid black; padding: 2px;">       FOR SOCIAL SECURITY AND TAX PURPOSES—NOT FOR IDENTIFICATION     </div>
---

Form OA-702.1 Rev. (11-61)

KEEP this card. SIGN it immediately. SHOW it to your employer. Mention the number in all letters about your account. If you lose this card apply for a duplicate, not a new number.

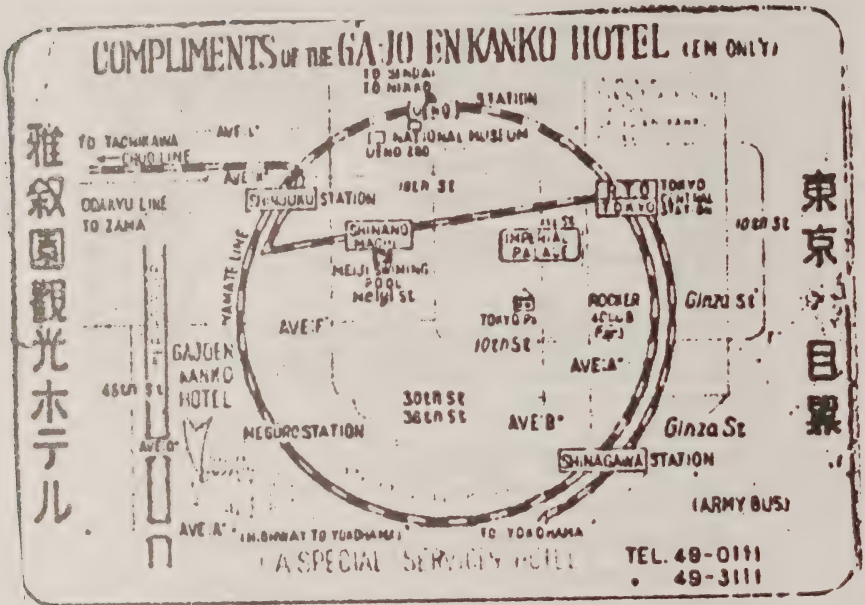
Once a year you can get a statement of wages credited to your account. Get a form for this purpose from any Social Security Administration District Office.

If you change your name notify the nearest Social Security Administration District Office immediately.

TELL YOUR FAMILY TO NOTIFY THE NEAREST SOCIAL SECURITY OFFICE IN THE EVENT OF YOUR DEATH. IT IS ADVISABLE TO GET IN TOUCH WITH A SOCIAL SECURITY OFFICE WHEN YOU REACH RETIREMENT AGE OR IF YOU BECOME SEVERELY DISABLED.

☐ DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE  
SOCIAL SECURITY ADMINISTRATION

(60) Undated. Complimentary card, GA-JO EN KANKO Hotel. Location: Archives.



(61) Three photographs of Oswald, one with the notation on the back, "taken at Camp Pendleton Feb. 5." Located in the HSCA files, Archives (unavailable at time of publication).



(62) Undated. Slip of paper with the following handwriting:

"The Worke  
23 W. 26th St.  
New York, 10, N.Y.  
The Worker  
Box 28 Madison  
Sq. Station, New York 10, N.Y.  
Embassy USSR  
1609 Decatur St. N.W.  
Washington, D.C."

Location: Archives.

The worke  
23 W. 26th St.  
new YORK 10, N Y  

---

THE WORKER  
BOX 28 MADISON  
SQ. STATION.  
NEW YORK 10, N Y

EMBASSY, USSR  
1609 DECATUR ST., N.W.  
WASHINGTON, D.C.  
CONSUL PLYUTENKO

1 267 INEV 3 70 75

**FBI** LATENT FINGERPRINT SECTION

FILE  
LC

**DECEASED**  
**FEDERAL BUREAU OF INVESTIGATION, UNITED STATES DEPARTMENT OF JUSTICE**  
 WASHINGTON, D.C.

**CURRENT ARREST OR RECEIPT**

DATE ARRESTED OR RECEIVED	CHARGE OR OFFENSE <small>(If code citation is used it should be accompanied by charge.)</small>	DISPOSITION OR SENTENCE <small>(List FINAL disposition only. If not now available, submit later on FBI form R-84 for completion of record.)</small>
11-22-63	Assassination of Pres. of U.S. Murder of Dallas Police Officer	Shot & Killed 11-24-63 while being transferred in custody
OCCUPATION	RESIDENCE OF PERSON FINGERPRINTED	
Photographer	1026 N. Beckley, Dallas, Texas	
If COLLECT wire reply or COLLECT telephone reply is desired, indicate here <input type="checkbox"/> Wire reply <input type="checkbox"/> Telephone reply <div style="text-align: right;">Telephone number _____</div>		
Sentence expires _____		

**DECEASED**

FOR INSTITUTIONS USE ONLY

**INSTRUCTIONS**

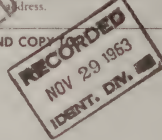
1. FORWARD ARREST CARDS TO FBI IMMEDIATELY AFTER FINGERPRINTING FOR MOST EFFECTIVE SERVICE.
2. TYPE or PRINT all information.
3. Note amputations in proper finger squares.
4. REPLY WILL QUOTE ONLY NUMBER APPEARING IN THE BLOCK MARKED "YOUR NO."
5. Indicate any additional copies for other agencies by space below—include their complete mailing address.

**DECEASED**

Please Paste Photograph in This Space

Since photograph may become detached indicate name, FBI number, and arrest number on reverse side whether attached to fingerprint card or submitted later.

SEND COPY



— Commission Exhibit No. 666 630 —



NAME *J. Hicks*  
*11/13/63*  
*Dallas PD*

SEX \_\_\_\_\_ RACE \_\_\_\_\_ DPD # \_\_\_\_\_ FBI # \_\_\_\_\_ DPS # \_\_\_\_\_


AGE \_\_\_\_\_ HT. \_\_\_\_\_ WT. \_\_\_\_\_ HAIR \_\_\_\_\_ EYES \_\_\_\_\_ COMP \_\_\_\_\_ OCC \_\_\_\_\_

DATE AND PLACE OF BIRTH \_\_\_\_\_

PRESENT ADDRESS \_\_\_\_\_

SCARS AND MARKS \_\_\_\_\_

DATE OF ARREST \_\_\_\_\_ CHARGE \_\_\_\_\_

ARRESTED BY \_\_\_\_\_ ARREST # \_\_\_\_\_

PRINTED BY \_\_\_\_\_ CLASSED BY \_\_\_\_\_ SEARCHED BY \_\_\_\_\_

NEAREST RELATIVE AND ADDRESS \_\_\_\_\_

*James Earl Ray*

POLICE DEPARTMENT DALLAS TEXAS

BUREAU OF IDENTIFICATION

FORM 12-5

Lee Harvey Oswald

Commission Exhibit No. 627

## REFERENCES

- (1) R. Popkin, "The Second Oswald" (New York: Avon Books/The New York Review of Books, 1966).
- (2) Id. at p. 63.
- (3) Ibid.
- (4) Ibid.
- (5) Id. at p. 66.
- (6) Sylvia Meagher, "Accessories After the Fact" (New York: Vantage Books, 1976), p. 360.
- (7) Report of the President's Commission on the Assassination of President Kennedy (Washington, D.C.: U.S. Government Printing Office, 1964), p. 319.
- (8) Id. at pp. 321-325.
- (9) Id. at pp. 320-321.

O











Western New England College Law Library



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